2012

Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

Noelle Morris
University of Windsor

LEARNING AND TEACHING WITH EMERGING TECHNOLOGIES: PRESERVICE PEDAGOGY AND CLASSROOM REALITIES

by

Noelle Morris

A Thesis
Submitted to the Faculty of Graduate Studies
through the Faculty of Education
in Partial Fulfillment of the Requirements for
the Degree of Master of Education at the
University of Windsor

Windsor, Ontario, Canada

2012

LEARNING AND TEACHING WITH EMERGING TECHNOLOGIES:
PRESERVICE PEDAGOGY AND CLASSROOM REALITIES

by

Noelle Morris

APPROVED BY:

_____

J. Singleton-Jackson (External Reader)
Faculty of Psychology

_____

C. Greig (Second Reader)
Faculty of Education

_____

Z. Zhang (Advisor)
Faculty of Education

_____

Darren Stanley, Chair of Defense

April 25, 2012

DECLARATION OF ORIGINALITY

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication.

I certify that, to the best of my knowledge, my thesis does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations, or any other material from the work of other people included in my thesis, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that I have included copyrighted material that surpasses the bounds of fair dealing within the meaning of the Canada Copyright Act, I certify that I have obtained a written permission from the copyright owner(s) to include such material(s) in my thesis and have included copies of such copyright clearances to my appendix.

I declare that this is a true copy of my thesis, including any final revisions, as approved by my thesis committee and the Graduate Studies office, and that this thesis has not been submitted for a higher degree to any other University or Institution.

ABSTRACT

This study was guided by the following research objectives: (1) investigating the relationship between the teacher education curriculum and field placements; (2) investigating how the technology experiences of teacher candidates in a teacher education program affect their experiences in a field placement experience; and (3) investigating situational, institutional, and/or dispositional variables that influence the integration of instructional technologies by teacher candidates in placements. Thirty-two teacher candidates in a consecutive teacher education program in Ontario completed questionnaires; additional interviews were conducted with four of these individuals. The data suggests that the participants in the required technology class were highly influenced by their faculty instructors' and mentor teachers' uses of technology, and the majority of the participants had very little experience with using technology for pedagogical and constructivist purposes. Technology integration in placements was ultimately dependent on the access and availability of resources, previous experience with available resources, technical support, and funding.

DEDICATION

This is dedicated to the many teachers, professors, and mentors who have encouraged me to question everything and explore the alternatives, both in education and in life. It is with this insatiable curiosity that I have attempted to pursue the answers to my never-ending and ever-surmounting questions. This has been both my blessing and my curse, but I would not have it any other way.

ACKNOWLEDGEMENTS

Many individuals have assisted and guided me through the process of completing this study, and they must be acknowledged. First and foremost, I have to thank my thesis advisor, Dr. Zuochen Zhang, whose continual feedback, patience, and willingness to let me do exactly what I wanted will be forever appreciated. By extension, thanks goes to my second reader, Dr. Christopher Greig, whose enthusiasm in my first grad school research paper motivated me to actually pursue my thesis. Thanks also to Dr. Jill Singleton-Jackson, who graciously agreed to act as the external reader in this study. The support and assistance provided by my thesis committee was invaluable to the project.

I am incredibly thankful to the teacher candidates who took the time to participate in the questionnaires and interviews. This study would not have been possible without these individuals, and it is my hope that their feedback and experiences will be considered in any future planning by the Faculty of Education. I thank them for their honesty, and I wish them the best of luck in their careers as educators.

A sincere thanks to Dan Edelstein in the Academic Data Centre for his tremendous patience in guiding me through the basics of SPSS, as well as answering my (sometimes frantic) questions. The existence of any quantitative data analysis in this study is owed to Mr. Edelstein, and Mr. Edelstein alone.

A special thank you to Julia Colella, whose support as a fellow thesis candidate and friend has helped me to get through and thoroughly enjoy my two years at the University of Windsor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

Every September, thousands of teacher candidates flood into faculties of education across Ontario. After approximately eight to ten months of intensive class work and placement experiences, the Ontario College of Teachers recognizes these individuals as qualified teachers – ready to enter the workforce and educate a new generation of students. As an increasing amount of educators and administrators work with the new "technologically savvy" generation of "digital native" students (Prensky, 2001; Steinweg, Williams & Stapleton, 2010) at the elementary and secondary levels, the question must be asked: are teachers – and more specifically, *new* teachers – actually ready?

Information and communications technologies (hereafter referred to as "technology") have evolved immensely over the past decade (Chmiliar & Cheung, 2007), and the expectations of teachers have also grown exponentially. Messinger-Willman and Marino (2010) argue that "Teachers must facilitate a learning environment that motivates students to reach high levels of academic achievement while ensuring that complex curricular materials are accessible to a broad range of students with diverse interests, prior experiences, and ability levels" (p. 5). In her commentary on the teacher's role in the classroom, Gorlewski (2008) comments that "our role is to acculturate students so that they can be successful in society. School achievement is intended to reflect both current and potential achievement outside of school" (p. 27). These comments are reflective of a shift that has and is occurring within many education environments around the world, and it is being recognized at the national and international levels by educators, administrators, and policy makers. With publications such as the Professional Advisory on the Use of

Electronic Communication and Social Media (OCT, 2011a) and the National Educational Technology Standards and Essential Conditions (ISTE, 2009) being released, it is evident that technology has created a blip on the radar in the world of teaching and learning.

In Classroom 2.0 – the informal term given to classrooms that are adopting new instructional technologies – the role of a teacher has evolved from a talking-head broadcaster and transmitter of static information, to a facilitator, adviser, content expert, coach, group facilitator, gatekeeper, and orchestrator of collaborative knowledge creation (Berk, 2009; Edutopia, 2008; Greenhow, Robelia & Hughes, 2009). The teacher's new role is to guide a new generation of "free-agent learners" who are using emerging and existent technologies (including social networking, cell phone applications, online classes, and podcasts) to personalize their learning, collaborate with peers, and share information – thus building a "personalized network of experts" (Project Tomorrow, 2010) and contributing to a collective intelligence (Kaminski, 2009). As a result of the numerous technological shifts that have occurred in the world and the classroom over the past decade, teacher education programs in Ontario (and, by extension, North America) have begun to develop and incorporate additional requisite and optional courses to tackle emerging issues (Laarhoven, Munk, Lynch, Bosma & Rouse, 2007). Available classes now include Learning with Technologies (The University of Windsor) and Educational Technology Leadership (Brock University), among others (Appendix A). Taking this even further, the University of Ontario Institute of Technology – "Ontario's first laptop-based university" (UOIT, 2012b) – has integrated computers into every class in its consecutive teacher education program, providing teacher candidates with orientation and ongoing training throughout the academic year in educational hardware and software (UOIT, 2012a).

In addition to the increase in compulsory teacher education training in emerging technologies, the literature also strongly argues that teacher candidates should have opportunities to observe faculty and classroom teachers using and modeling relevant and meaningful technology in classroom environments (Marino, Sameshima & Beecher, 2009). While the faculty classes are important in establishing a pedagogical foundation for teacher candidates, Laarhoven et al. (2007) suggest that it is through the process of faculty modeling, experiential learning, and field experience that teacher candidates develop and cement their dispositions towards technology. If technology is modeled as a means to enhance instruction and access to the curriculum within teacher education programs and professional development activities, teacher candidates may be more disposed to incorporate these tools into their own classrooms and field experiences.

Despite this, there is often a disconnection between faculty-based teacher education learning experiences and field placement classroom realities, especially those involving the integration of technology (Israel, Knowlton, Griswold & Rowland, 2009; Smith, Kelley, Maushak, Griffin-Shirley & Lan, 2009). Since teacher education programs exist as a preparatory step for classroom realities, they "have a responsibility to train educators in the necessary knowledge, skills, and motivation to provide a bridge between students and technology" (Safhi, Zhou, Smith & Kelley, 2009, p. 562). However, there are situational, institutional, and dispositional variables that affect whether this "responsibility" to integrate technology will be fulfilled in both teacher education facilities and field placement environments.

1.1 Research questions

This study was guided by the following research questions:

1. What is the relationship between the teacher education curriculum and classroom realities met by the teacher candidates in their field experiences?
2. How does a teacher candidate's experience with technology in the teacher education program affect their experience with technology in their field placement experience(s)?
3. What situational, institutional, and/or dispositional variables influence a teacher candidate to use or not use technology in their field placement experience(s)?

1.2 Purpose

While it is assumed that "digital native" teacher candidates are "technologically competent", there are numerous variables that affect whether these individuals – as well as "digital immigrant" teacher candidates (Prensky, 2001, p. 2) – will or will not implement technology in their placements and future classrooms. Through a questionnaire and focus groups, the study is intended to investigate the situational, institutional, and dispositional variables that can affect the relationship between the teacher education curriculum in technology and the classroom realities that are met by the teacher candidates in their field experiences. The study investigates whether the technology training and/or equipment needs of the teacher candidates are being met both in the teacher preparation classes and their field placement environments, at both the elementary and secondary levels.

1.3 Theoretical framework

This study was conducted under the context of the International Society for Technology in Education's (ISTE) Essential Conditions (ISTE, 2009) for effectively leveraging technology through teaching and learning. A thorough examination of the variables that affect whether or not teacher candidates will use technology in their field

placements requires a framework that recognizes multiple conditions as necessary for effectively integrating technology into instructional practices (ISTE, 2009). The fourteen conditions, which will be explained below, are broad and context-dependent, and allow individual educators and schools to evaluate "the skills and knowledge educators need to teach, work, and learn in an increasingly connected global and digital society" (ISTE, 2011b). The conditions are currently being used as guidelines for technology integration in various schools and ministries around the world, including Norway, Costa Rica, Malaysia, Japan, Australia, Philippines, Micronesia, Korea, Turkey, and Puerto Rico. ISTE stresses that teachers are now "digital age professionals" and "co-learners" in their classrooms, and should be modeling technology uses that allow their students to analyze, learn, and explore in preparation for their participation in an increasingly connected world (ISTE, 2011a).

ISTE has identified the following conditions as essential for digital age teaching:

1. A **Shared Vision** of educational technology by teachers, support staff, school administrators, district administrators, teacher educators, parents, and the wider community.
2. **Empowered Leaders** who support technological change at every level within schools and districts.
3. Systemic **Implementation Planning,** wherein school effectiveness and student learning are supported by different technologies.
4. **Consistent and Adequate Funding** to “support technology infrastructure, personnel, digital resources, and staff development.”
5. **Equitable Access** to technology (both current and emerging) for all individuals within a school community.

6. **Skilled Personnel** within a school to select and effectively use appropriate technology resources.
7. **Ongoing Professional Learning** dedicated to technology, with a focus on sharing ideas and hands-on experiences.
8. Reliable **Technical Support** to assist in the maintenance, renewal, and utilization of various technologies.
9. A **Curriculum Framework** that aligns with and supports technology in the digital age school environment.
10. **Student-Centered Learning** that is concerned with students' unique needs and abilities in the planning, teaching, and assessment stages.
11. Continuous **Assessment and Evaluation** of the teaching and learning processes, the school leadership, and the technologies themselves.
12. **Engaged Communities** that "support and fund the use of ICT and digital learning resources."
13. **Support Policies** concerning finances, accountability, and incentives in technology.
14. Policies and initiatives **(Supportive External Context)** that exist at the national, regional, and local levels to aid schools and teacher preparation programs in curriculum-focused technology implementation (ISTE, 2009).

The Essential Conditions were selected as the primary theoretical framework because they encompass aspects of other relevant frameworks that exist and are relied on within the reviewed literature, including social constructivism (Vygotsky, 1978), the Technology Acceptance Model (TAM) (Davis, 1989), self-efficacy (Bandura, 1977), and

technological pedagogical content knowledge (TPACK) (Mishra & Koehler, 2006). These particular frameworks will be explored in greater detail in the literature review.

The conditions were also selected because they can be applied in varying contexts and environments. This is important within the study because the teacher candidates' experiences and perceptions were entirely context-dependent – for their first placement, each teacher candidate had an entirely unique experience based on the fact that they had different mentor teachers and grade levels within different classrooms and schools. The "essential conditions" allow researchers to examine the factors that facilitate technology integration (and conversely, the factors that inhibit technology integration) under a broad and varied set of experiences, perceptions, and individuals.

This study encouraged teacher candidate participants to consider, examine, and evaluate the various conditions and variables that affected their personal technology integration and application within two distinct but connected environments: (a) the Faculty of Education, and (b) the field placement classroom. It was expected that the conditions would not be wholly met in each environment for every individual, but it was hoped that the existence of even a few variables would incentivize teacher candidates to see the value in educational technology.

1.4 Outline of chapters

Chapter II reviews the relevant literature pertaining to the issues of technology in teacher education. Drawing primarily from (1) studies of teacher candidates and (2) studies of practicing teachers, this chapter explores the factors that affect whether or not teacher candidates will use technology in their placements and future classrooms based on the existing literature.

Chapter III outlines the research design that was utilized in this study and explains how the relevant literature was selected, in addition to introducing the participants and context of the study. The procedures for data collection and data analysis are explored in detail, and the ethical considerations of this study are addressed.

Chapter IV provides a summary of the study's quantitative and qualitative findings. Findings are addressed according to (1) the teacher candidates, (2) the teacher education program, and (3) the field placements.

Chapter V provides a review of the major findings and how they relate to the reviewed literature and research questions. The chapter also discusses the limitations of the study, in addition to offering suggestions for future research and recommendations for practice.

CHAPTER II

LITERATURE REVIEW

This chapter reviews the relevant literature surrounding technology in teacher education, and explores how the integration of technology by teacher candidates is influenced by their experiences in the faculty, their field placements, and their own K-12 and undergraduate educations. This study draws primarily from two main bodies of literature: (1) studies of teacher candidates, and (2) studies of practicing teachers. To fully understand the variables that affect a teacher's decision to integrate technology, it is important to examine the practices, perceptions, and experiences of teachers in various stages of their careers and lives. The faculties and the in-school practicum experiences cannot be studied autonomously of one another because they concurrently influence teacher candidates.

This chapter explores the situational, institutional, and dispositional variables that affect whether and how technology training is integrated into teacher education programs, field placements, and schools. Before investigating how teachers currently use technology and the factors that influence this use, it is important to understand the changing roles of our students, teachers, and schools in response to technological changes in today's world. Specific factors explored in this literature review include the context, the individual, the teacher education program, and the field experience.

2.1 An examination of technology in today's world

Before examining the state of technology in teacher education programs and field placement classrooms, it is important to consider the state of technology in the broader world. Around the world, technology is seen as both essential and pervasive to modern

life (Lambert & Gong, 2004; Wheeler & Wheeler, 2009). Ubiquitous and integrated, technology is one of the primary means by which people communicate and network in our "flat world" (Thieman, 2008, p. 342) and "information society" (Davis & Loveless, 2011, p. 254). Rapidly evolving information and communication technologies allow for globalized connections that transcend physical geography and time zones, and the Internet has and continues to facilitate this technological evolution (Chai & Lim, 2011).

The past decade has seen a transformation of technology and the Internet and how these tools are accessed, and this has directly impacted the lives of our students and younger teachers. An examination of the shift in how the Internet has been used best exemplifies how technology in general has evolved. The static Web 1.0 "predominantly (…) involved hierarchically arranged websites with information largely controlled by a small group of content providers" (Greenhow et al., 2009, p. 247), while the new Web 2.0 – and, more recently, Web 3.0 – allows Internet users to connect, create, collaborate, and exchange information with other people around the world in instantaneous and dynamic ways through various social networking sites, web tools, and mobile devices (Buechler, 2010; Greenhow et al., 2009; Handsfield, Dean & Cielocha, 2009; Kaminski, 2009; Lemke, Coughlin, Garcia, Reifsneider & Baas, 2009). The "read-write web" (also called the "social web") is a place where readers have the opportunity to become writers, publishers, producers, and directors (Wheeler & Wheeler, 2009, p. 2). And unlike the first generation Web, a great deal of Web 2.0/3.0 activity and correspondence occurs on mobile devices, with no clear distinction between being online and offline. Wheeler and Wheeler (2009) claim that "It is imprudent to ignore the social web because it enables students to participate in new forms of literacy that contribute towards collective knowledge" (p. 2). It is also imprudent to ignore how the extracurricular uses of

technology by teacher candidates and beginning teachers may or may not affect how they use technology in the classroom.

Despite the increasing emphasis on technology and the Internet in the economy, the workforce, and society, "education is dead last in technology use…education is the least technology-intensive enterprise in a ranking of technology use among 55 U.S. industry sectors" (Vockley, 2008, p.2, as cited in Lambert & Gong, 2004, p. 55). There are growing expectations that teachers – regardless of age or experience – will train students to live and work in an information society as "independent, creative and lifelong learners" (Teo, Lee, Chai & Choy, 2009, p. 535), but the adoption and implementation of information and communication technologies by teachers, schools, and school boards has been relatively slow (Chai & Lim, 2011; Steinweg et al., 2010). By extension, teacher education programs are now expected to prepare teacher candidates with theoretical and hands-on experiences to use emerging technologies in learning and teaching, but there are many challenges to implementing technology into teacher education programs. These issues will be discussed in further detail in Section 2.3.3, "Teacher education programs and technology".

2.1.1 The Changing Roles of Teachers and Schools

Researchers and educators alike recognize the numerous benefits of information and communications technologies for teaching and learning. From the teaching perspective, the use of technology allows for the efficient creation and reuse of lesson plans and presentations, and also allows teachers to easily share and organize resources with colleagues. From the learning perspective, technology can be used as a multimodal means to meet the needs of more students, thereby increasing student engagement (Sang, Valcke, van Braak & Tondeur, 2010). Technology is viewed as modern and relevant to

this generation of students, and allows for increased access to interactive and dynamic resources. Through the interaction of different audiences and perspectives in ICT, technology can also be used as a means to develop and foster students' critical literacy skills, collaborative abilities, and overall engagement with the curricular content. From both perspectives, time and location are no longer of great significance to the teaching and learning processes. ICT allows for "anytime, anywhere" learning that can be adapted and customized to the individual student's needs and abilities (Hammond, Reynolds & Ingram, 2011).

Acknowledging these benefits, the general expectation within many educational systems around the world is that teachers will incorporate technology into their curricula and teaching practices (Chen, 2010; Teo, 2009a). Recognizing the potential benefits in information and communication technologies for the field of education, many people in the field have advocated for constructivist reforms that challenge traditional notions of schooling and promote "the effective and innovative use of ICT in education" by educators (Chen, 2010, p. 32). In this new paradigm of "meaningful learning" (Donnelly, McGarr & O'Reilly, 2011, p. 1479), knowledge is co-constructed by the teacher(s) and the students (Chai, Koh & Tsai, 2010). With the advent of technological reforms, teachers are now perceived as change agents and facilitators of student learning, versus all-knowing information transmitters and knowledge authorities (Gao, Chee, Wang, Wong & Choy, 2011; Mueller, Wood, Willoughby, Ross & Specht, 2008; Teo, 2009a).

Despite the fact that information and communication technologies are becoming increasingly accessible in schools with progressively favourable student-device ratios and greater teacher experience (Hammond, Crosson, Fragkouli, Ingram, Johnston-Wilder, Johnston-Wilder, Kingston, Pope & Wray, 2009a), technology is still ineffectively and

under-used by most educators (Chen, 2010; Mueller et al., 2008). Sahin (2011) notes that teachers have a responsibility to their 21st century learners to integrate technology into the classroom, but "proficiency alone does not appear to be enough to facilitate effective integration into teaching practices" (Gronseth, Brush, Ottenbreit-Leftwich, Strycker, Abaci, Easterling, Roman, Shin & van Leusen, 2010, p. 30).

2.1.2 The Digital Natives

We know that our students are active users of various technologies, spending upwards of 7½ hours per day online (Foehr, Rideout, Ulla & Roberts, 2010). As "produsers" – users of a medium who are also producing original or remixed content (Bowman & Willis, 2003) – they are engaging in creating, composing, blogging, and sharing on the Web, through social networking, and on their mobile devices. Since Prensky's (2001) declaration of the term 'digital native' to describe individuals who have spent their entire lives surrounded by technology, digital natives have been mentioned and explored in much of the literature pertaining to the integration of technology in schools, but the majority of these studies have examined digital natives within the K-12 student population. Many 'digital natives' are now entering the teaching profession (Lei, 2009), and limited research has been conducted as to how these allegedly digitally-able and digitally-literate "saviours" from the ICT generation are integrating their knowledge of ICT into teaching and learning practices (Hammond et al., 2011; Starkey, 2010).

Prensky (2001) claims that digital natives are inherently different from digital immigrants because they have spent their entire lives "surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age" (p. 1). Because of their constant exposure to technology, Prensky posits that digital natives think and process information in fundamentally and

radically different ways from digital immigrants, and "Today's students are no longer the people our educational system was designed to teach" (Prensky, 2001, p. 1). The digital natives allegedly approach learning differently, and are tech-savvy multitaskers (Lei, 2009) who are comfortable with learning new software quickly and easily (Hammond et al., 2009a). Digital immigrants, on the other hand, speak an "outdated language" and "struggle" to teach the digital natives (Prensky, 2001, p. 2).

Schools and administrators often assume that digital native teachers will transform schools with their 'intrinsic' knowledge and 'natural' efficacy that has resulted from growing up in a digital world (Duncan & Barnett, 2009; Lei, 2009). It is true, for the most part, that teacher candidates are well versed in the use of recreational and social technologies. The literature cites teacher candidates' widespread experiences with social networking, mobile devices, and the online world before even beginning their teacher preparation programs (Hammond et al., 2009a; Hammond et al., 2011; Gao, Wong, Choy & Wu, 2010; Lambert & Gong, 2004). New and accessible tools are emerging and being used by digital natives on a daily basis (Steinweg et al., 2010). The digital natives are perceived to be more knowledgeable about technology than their more experienced colleagues (Gao et al., 2010), but this does not guarantee that they will use technology for student-centred learning practices.

Duncan and Barnett (2009) suggest that because the new generation of digital native teachers is assumed to be confident, efficient, and optimistic with technology, some teacher education programs only provide optional courses in technology. Where technology courses are required, the focus is "more on software applications than on technology-infused curriculum design" (Duncan & Barnett, 2009, p. 360), which is what the teacher candidates are experientially lacking.

2.1.3 Additional questions of age and gender

While a perceived gap exists between digital natives and digital immigrants, a study conducted by Guo, Dobson, and Petrina (2008) suggests that the alleged digital divide between the digital 'natives' and the digital 'immigrants' has been exaggerated. There is limited research that actually examines the relationship between age and technological competence, and it is not actually clear how informal, recreational, or superficial exposure to technology affects how digital native teachers will use technology in their classrooms. While many of today's teacher candidates belong to the digital native generation, it is important for all educators to realize that "they are not yet digital-native preservice teachers" (Lei, 2009, p. 92) who can use technology in critical, wise, and meaningful ways to encourage responsible digital citizenship and constructivist learning. Today's digital native teacher candidates are also not a homogeneous group – they have their own varied experiences and skill sets with technology, in addition to access to technology. There are challenges associated with transferring existing technology skills into the context of a classroom (Hammond et al., 2011), especially in the first few years of teaching. Conversely, experienced teachers may have more time and available resources to explore how technology can enhance the teaching and learning in their classrooms (Mueller et al., 2008).

While researchers have previously examined gender as a contributing factor in a teacher's computer efficacy and subsequent use of ICT, studies conducted by Sang et al. (2010), Lambert and Gong (2004), and Hammond et al. (2011) concluded that gender does not play a significant role in the integration of technology into individual classrooms. In their study of eleven sections of a stand-alone technology course, Lambert and Gong (2004) observed "the narrowing of a gender gap in regard to general computer

use" (p. 67). Several years after this study was conducted, Hammond et al. (2011) also noted that gender as an influencing factor "was not apparent within either the quantitative or qualitative data" (p. 201) when they investigated the reasons for student teachers' technology use in a cohort of student teachers.

Acknowledging the mixed opinions and data, it is still worthwhile to examine how effectively the digital natives are using technology in their teaching, how their technological efficacy is affected, and how their extracurricular technology uses translate to the classroom environment.

2.2 Teachers and Technology

The reviewed literature presents many factors that can encourage or inhibit an educator – preservice *or* inservice – from integrating technology into his or her classroom. The literature explores how teachers think technology should be used, as well as the persuading and inhibiting factors that are involved in implementation decisions. Despite the overwhelming potential of these ever-evolving tools, it must be acknowledged that there are great divides in schools with respect to the integration of technology and the Internet. There is a tendency for educators and administrators to be either "euphorically optimistic about the technology's potential" or "mordantly disturbed by its perversions, in almost equal measure" (Ross, 2010, p. 123), based on any or all of the variables that will be discussed in this section of the literature review.

This section will explore how teachers are currently using technology, the factors that propel them to do so, and the ongoing challenges that exist in the integration of educational technologies.

2.2.1 Uses of technology

The authors in the reviewed literature generally agree that teachers and teacher candidates use technology in one of two ways. The first way that teachers tend to use technology revolves around using new technology in old or basic ways. The teacher uses a specific technology tool as a "teaching machine" to transmit information, regurgitate content, and monitor student progress (Chai et al., 2010; Donnelly et al., 2011; Mueller et al., 2008; Teo et al., 2009), as well as to keep records, communicate with others, and conduct research on the Internet (Sutton, 2011). Chai et al. (2011) and Thieman (2008) report that technology is infrequently used for the purposes of instructional activities, and that educators often fail to use technology in ways that promote students' knowledge construction. This is evidenced by teachers involved in Lei's (2009) study, who valued 'traditional' technologies and ways of learning. One participant commented that "technology should not replace everything" (p. 90), while another participant voiced their concern that technology was "a double-edged sword" (p. 91). These participants saw the value in technology, but were concerned that technology could fail and that students would be distracted. Participants also discussed their concerns about computer dependency and the need to use technology in moderation. The ease of use of technology must also be considered: when teacher candidates and teachers perceive new technologies as difficult to learn and use, the literature suggests that they will choose the easiest and most familiar medium (Shoffner, 2009; Starkey, 2010; Teo, 2009b), which often means that they will revert to traditional technologies and learning designs.

The second (and *newer*) way that teachers use technology is through a constructivist mindset. The constructivist view encourages teachers to use technology to "expand classroom boundaries, connect students to real-world events, and guide students

to become independent learners" (Teo, 2009a, p. 7) through active and cognitive learning. When faced with new constructivist technologies in DeGennaro's (2010) case study, teacher candidates were seemingly confused and bewildered by their new roles as co-constructors of knowledge, as well as the lack of a traditional transmission-oriented course structure. Even as tech-savvy digital natives, the teacher candidates in DeGennaro's study were influenced by the traditional methods and spaces within which they had been educated, and found it difficult to use technology for student-centred learning.

While the ideals that guide constructivist education sound appealing, constructivist education is not without its challenges. Teachers can rely on structure within traditional teaching; contrarily, constructivist teaching thrives on a lack of structure. To be truly "innovative" with technology requires that teachers use technology to support student-centred learning in novel ways, and this is not necessarily something that has been modeled for teacher candidates in their own K-12 and university experiences (Chai & Lim, 2011; Chen, 2010; Hammond, Fragkouli, Suandi, Crosson, Ingram, Johnston-Wilder, Johnston-Wilder, Kingston, Pope & Wray, 2009b; Schneiter, 2010). Student-centred learning and a supportive curricular framework are, however, recognized as essential conditions for technology integration by ISTE. Constructivism recognizes that "tools by themselves will not transform pedagogy" (Campbell & Martin, 2010, p. 70), and this is the primary challenge that traditionally-educated and trained teachers face when integrating technology into their classrooms without any curricular guidance. Linked to the constructivist perspective is TPACK (Mishra & Koehler, 2006), which encourages the synthesis of a teacher's technology knowledge (TK), pedagogical

knowledge (PK), and content knowledge (CK). The framework for TPACK is illustrated in Figure 1.

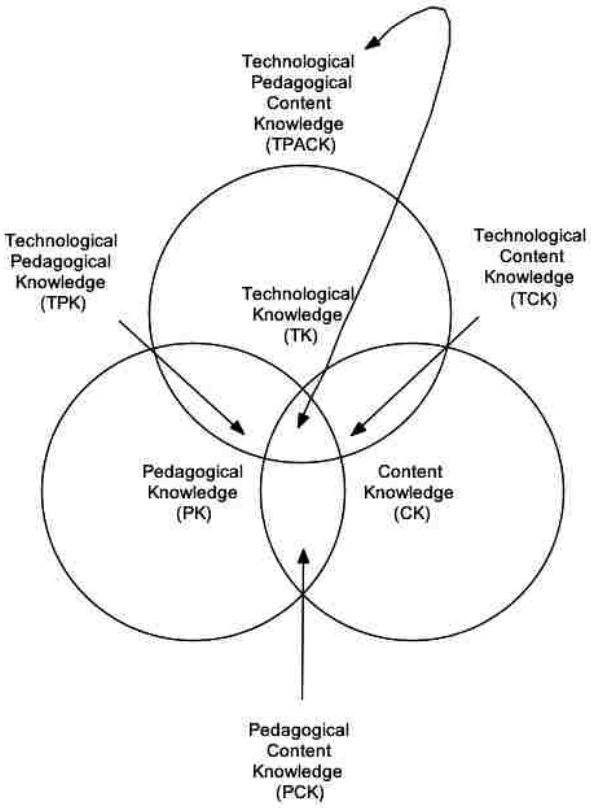

Figure 1. The Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006, p. 1025).

Considering the traditional and constructivist perspectives, the literature suggests that an increasing number of teacher candidates and inservice teachers are attempting to integrate technologies in ways that adhere to both perspectives. In order for teachers to effectively integrate technology into their classrooms, it is necessary that they be proficient in the traditional *and* constructivist applications of technology (Adcock & Bolick, 2011). Outside of the classroom, teachers generally use technology for lesson planning, grade and data management, sharing and organizing resources, communicating with other teachers and parents, and video conferencing. In the classroom, there are

instances of teachers using technology for multimedia presentations, classroom demonstrations and explorations, class web pages and blogs, images and movie clips, concept mapping, digital storytelling, movie making, and the facilitation of group work and homework assignments. The tools being used include (but are not limited to) personal computers, interactive white boards, LCD projectors, presentation software, the Internet, various Web 2.0 applications, wikis, digital flexbooks, graphing calculators, spreadsheets and word processors, cell phones and other mobile devices, educational software, mobile data collection units, iPods and iPads, and digital/video cameras (Adcock & Bolick, 2011; Chai et al., 2010; Donnelly et al., 2011; Hammond et al., 2009a; Hammond et al., 2011; Schneiter, 2010; Steinweg et al., 2010; Thieman, 2008).

Tools such as digital storytelling platforms and wikis are increasingly being used to motivate and encourage students of all abilities. These specific tools allow students to develop and foster their self-efficacy through constructivist, student-oriented practices (Adcock & Bolick, 2011). Similar mediums allow participants to co-construct knowledge and meaning, which promotes constructivism in the classroom. When possible, teachers are using educational technology tools as classroom motivators and information mediators (Schneiter, 2010). Additionally, teachers are using educational technologies to present information in more than one format because the multimodal representation of information and ideas increases the chance that more students will learn and retain information in the classroom (DeGennaro, 2010; Schneiter, 2010; Steinweg et al., 2010). Donnelly et al. (2011) elaborate that in subject areas such as science, the use of various multimedia technologies can help students to understand, visualize, and engage with certain dynamic concepts, such as global warming. They also comment that teachers do see the value in technology as an instructional tool and will use it if the “right conditions”

are present (Donnelly et al., 2011, p. 1470). Some of the conditions pertinent to this study will be explored in Section 2.3.

2.3 Factors that affect technology use

Research documents that various factors affect technology integration and classroom use. In addition to the influence of technology use and modeling in the teacher preparation programs and field experiences, the literature explores several other factors that affect preservice and inservice educators. For the purposes of this review, the factors have been examined in the following categories: (1) the context, (2) the individual, (3) the teacher education program, and (4) the field placement. It is emphasized in the literature that the effective integration of technology is dependent on the existence of multiple and interacting facilitating conditions – environmental factors that encourage or discourage an individual from the use of instructional and educational technologies (Teo, 2009b; Teo et al., 2009). If only one factor is present, there is no guarantee that technology will be integrated effectively or at all.

2.3.1 The context

The context of a school can affect if and how a teacher chooses to integrate technology into his or her classroom. The context includes external and environmental factors that are *exogenous* and *extrinsic* to teachers (Chai & Lim, 2011; Chen, 2010; Lambert & Gong, 2004; Mueller et al., 2008), and includes access, support, and the school culture. In order for a context to be supportive of technology integration, ISTE recognizes that there needs to be consistent and adequate funding "to support technology infrastructure, personnel, digital resources, and staff development" (ISTE, 2009).

Access is one of the primary motivators and inhibitors to technology use by preservice and inservice teachers. While access to various technologies has indisputably

improved across North America (Mueller et al., 2008), there is still a "lack of access to adequate technology in the K-12 schools" (Thieman, 2008, p. 356) and many teacher candidates and inservice teachers view access as one of the top challenges to technology integration (Gao, Choy, Wong & Wu, 2009). To expand on Thieman's statement, it must be understood that "increased access to technology does not mean increased use of technology in classrooms" (Lei, 2009, p. 92). On the one hand, teachers need to be able to access the physical hardware (i.e., computers or interactive white boards) and software (i.e., SMART Notebook or PowerPoint). On the other hand, teachers need to be able to access "appropriate" types of educational technologies that support student-centred learning in a classroom (Chen, 2010).

The literature provides many examples that demonstrate the broad scope of teacher candidate experiences in relation to access. Case studies conducted by Starkey (2010) demonstrate the inequitable access to technology that often exists *within* schools. Participants in Starkey's case studies were discouraged by the fact that only permanent teachers were given laptops, and that specific hardware and software was only available to specific departments within the school. Two other teachers in Starkey's study discussed the trouble they had in accessing basic power supplies. This comes into conflict with the Equitable Access condition set out by ISTE's Essential Conditions (ISTE, 2009), which stipulates that there should be "Robust and reliable access to current and emerging technologies and digital resources, with connectivity for all students, teachers, staff, and school leaders" (ISTE, 2009).

Access to shared computer rooms and communal school resources (such as interactive white boards and video cameras) is also discussed by several of the researchers (Hammond et al., 2009b; Hammond et al., 2011; Starkey, 2010). One

participant in Hammond et al.'s (2009a) study lamented, "If you want the children to use the computers in the ICT room you have to book three weeks in advance so that is not easy" (p. 68). Thieman (2008) makes the point that computer labs are often unavailable for weeks at a time to administer state tests. Moving rooms for the purpose of using technology is also viewed as "disruptive" (Hammond et al., 2011, p. 197).

Access to technical support is viewed as an important facilitating condition in teacher technology use (Hammond et al., 2009b; Hammond et al., 2011; Teo, 2009b; Teo et al., 2009; Thieman, 2008), and is recognized as an essential condition by ISTE (ISTE, 2009). In order to maintain, renew, and use educational technologies, teachers require consistent and reliable access from a technical support staff (ISTE, 2009; Thieman, 2008). Teachers also require access to skilled personnel who are "skilled in the selection and effective use of appropriate ICT resources" (ISTE, 2009).

The literature also identifies access to technical support as a significant contributing factor to the development and growth of a teacher candidate's confidence, efficacy, and commitment to ICT (Hammond et al., 2009b; Teo et al., 2009). The use of technology as a pedagogical tool cannot be fully realized unless there is adequate access to technical support and modeling within a school (Teo et al., 2009). While access is generally perceived to be an external factor (Sang et al., 2010; Starkey, 2010), it can have direct effects on the internal factors that encourage or discourage teachers from using technology in the classroom. If appropriate access, training, materials, modeling, and technical support are provided, it is argued that teacher candidates may be more disposed to use technology in their own classrooms based on the foundational experiences with technology in their field placements: "Student teachers needed ready access in order to

use ICT and they needed to use ICT frequently in order to become good users of ICT" (Hammond et al., 2009b, p. 94).

Access to various educational technologies within the university environment is also viewed as a motivator in the use of technology by teacher candidates. Similar to individual practicum environments, access to technology varies within individual teacher education faculty environments. While many teacher education programs now have required educational technology courses, participants in Sutton's (2011) study commented that "they rarely used these technology-rich environments, aside from the required technology course" (p. 45). This is demonstrative of a potential lack of faculty use and modeling of technologies within other teacher education courses.

As discussed, access to technical support is a key contributing factor when considering whether or not teachers will utilize educational technologies. In the context of a school, the idea of support also extends to a network of supportive and empowered colleagues and administrators who can "be leaders in effecting change" (ISTE, 2009). Teacher candidates and beginning teachers are often influenced by other teachers within their departments, who act as formal and informal mentors and role models. The level and type of departmental and administrative support for teacher candidates and beginning teachers can and often does influence whether or not they will use technology. If a school is driven by standardized tests or examinations, teacher candidates and beginning teachers may see no urgency to integrate educational and constructivist technologies. However, if the appropriate support and encouragement for technology is in place, it is more likely that teachers will use technology to act as change agents (Chai & Lim, 2011).

The types of available support often depend on the culture of the individual school, which has existing values and practices to which teacher candidates and

beginning teachers must adjust (Hammond et al., 2009a). The school culture embodies the perceptions and experiences of numerous individuals and conflicting ideologies, and it is not guaranteed that all teachers will be supported in the same ways (Starkey, 2010). School cultures also consist of varying assessment systems, curricular structures, and school policies (Chai & Lim, 2011), and often differ in scheduling (Chen, 2010). In the more specific case of beginning teachers, there is the expectation that they will "participate fully in the practice of the school and the department from the first day of their employment," even with a workload that is considered to be "90 per cent of that of more experienced colleagues" (Swabey, Castleton & Penney, 2010, p. 31). When faced with the overwhelming facets of a school culture, it is especially pertinent that teacher candidates and beginning teachers be fully and formally supported and introduced to the "shared vision" and technology implementation plan that is held by the school and community (ISTE, 2009).

The process of becoming part of a school culture can be made easier for beginning teachers if appropriate "essential" conditions are in place. Beginning teachers should have the opportunity to observe how colleagues implement ICT and deal with challenges in the classroom (Gao et al., 2009). Schools should also provide ongoing technology-related professional learning with time allotted for discussion and hands-on practice (ISTE, 2009). Additionally, schools should have appropriate support policies, financial plans, accountability measures, and incentive structures "to support the use of ICT and other digital resources for learning and in district school operations" (ISTE, 2009).

2.3.2 The individual

Personal attributes and individual characteristics also help to determine whether or not teachers will use technology in schools. These endogenous and intrinsic factors

include an individual's self-efficacy, their attitude towards technology, and their personal existing experiences with technology (Chai & Lim, 2011; Chen, 2010; Gronseth et al., 2010).

When integrating technology into the classroom, a teacher's attitude can act as a barrier or enabler, regardless of the technologies that are available to them within the school. Hammond et al. (2011) found that "those with more positive attitudes to ICT tended to report more frequent use of ICT" (p. 196). When teacher candidates have the opportunity to tacitly observe the benefits of technology in teaching and learning, they are more likely to adopt positive attitudes towards technology integration (Lambert & Gong, 2004).

Also lending to a positive attitude is an individual's self-efficacy. Self-efficacy is referenced as an influential factor to technology integration in much of the reviewed literature. It is defined by Bandura (1997) as the ''beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). These beliefs are the result of an accumulation of social influences and personal experiences (Lambert & Gong, 2004), and influence the level to which an individual will perform a task, if at all. Self-efficacy is context-dependent: in the consideration of teacher candidates, technology efficacy is dependent on existing skills and perceived efficacy, teacher education program experiences, and field experiences, all of which contribute to whether or not technology will be used as an instructional tool (Browne, 2009). Teachers who possess high levels of computer efficacy and teaching efficacy are more likely to successfully implement technology to achieve their classroom's pedagogical goals (Mueller et al., 2008).

Davis (1989, cited in Teo, 2009b, p. 303) presented the Technology Acceptance Model (TAM) (Figure 2), which illustrates the interconnected relationships between external and internal variables that ultimately influence one another in a teacher's technology acceptance and integration. When deciding whether or not to use technology, an individual (who is often influenced by external variables) decides if the tool will be useful and if it will be easy to use. The perceived usefulness and ease of use are interconnected, and ultimately influence the individual's attitude towards and intention to use a specific tool.

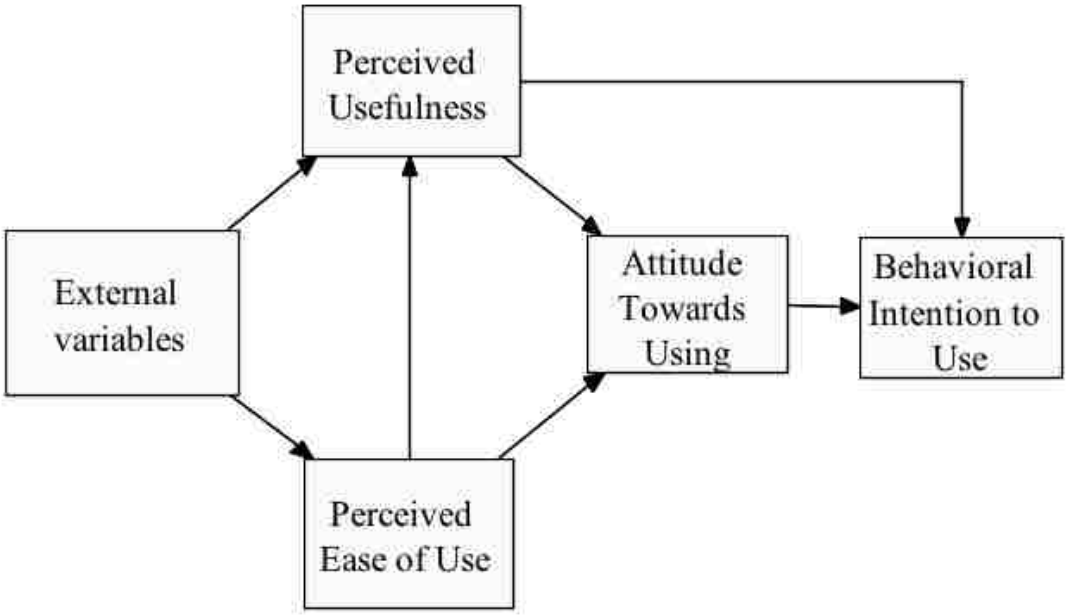

Figure 2. Davis' (1989) Technology Acceptance Model (cited in Teo, 2009b, p. 303).

2.3.3 Teacher education programs and technology

Despite the relatively slow pace of technology integration in K-12 schools, teacher education programs are not static or non-responsive to national and international developments. In response to large and small scale social, political, and economical changes and informed by current research, teacher education programs are ever-evolving

in their attempts to provide teacher candidates with timely theories and experiences (Steinweg et al., 2010). However, the technological emphasis differs between programs (Appendix A).

In the face of major ICT reform and global technological change, "Teachers must not only be able to use the technology of the day but be prepared to handle tools of the future" (Teo, 2009a, p. 14). Schneiter (2010) also stresses the importance of learning how to use current tools while simultaneously learning "to identify and appropriately use (…) the ever-increasing array of resources" (p. 461). Teachers who have limited technology training within teacher preparation programs may be reluctant to integrate technology into classrooms (Messinger-Willman & Marino, 2010). Even if technology devices are available within an institution, a lack of training and a teacher's disposition towards his or her competence levels may lead to technology abandonment, wherein "complex and costly devices are cast aside when the student, (or) teacher (…) are not trained in how to use the device(s)" (Dyal, Carpenter & Wright, 2009, p. 558).

Chai et al. (2010) make the claim that the "failure to raise the teachers' competence during preservice education may result in the preservice teachers quickly forsaking the use of ICT in practice" (p. 70). For many teacher candidates with little or no educational technologies training, exposure to and practice with ICT during preservice training is critical to the development of their technological self-efficacy (Chai et al., 2010). If preservice programs exist as a preparatory step for classroom realities, they then "have a responsibility to train educators in the necessary knowledge, skills, and motivation to provide a bridge between students and technology" (Safhi, Zhou, Smith & Kelley, 2009, p. 562).

2.3.3.1 Strategies to develop tech proficiency

Because there is no overarching standard, each teacher education program is responsible for implementing its own strategies in the development of teacher technology training and curricula. Strategies include one-day mini workshops, professional training, stand-alone technology courses, the integration of technology into every course, field experiences, project-based courses, and/or a combination of any of the aforementioned strategies (Gronseth et al., 2010; Mueller et al., 2008; Sang et al., 2010).

Several researchers take issue with the existing optional and mandatory stand-alone instructional technology courses, and argue for the infusion of technology training and modeling across the entire teacher education curricula – more specifically, into methods courses (Chai & Lim, 2011; Duncan & Barnett, 2009; Lei, 2009; Sutton, 2011). These researchers argue that despite required technology courses and strong beliefs about technology's potential in the classroom, teacher candidates are hesitant and unprepared to use technology in their own classrooms and subject areas: "teaching ICT skills alone does not adequately prepare preservice teachers to integrate ICT" (Chai et al., 2010, p. 64). Mueller et al. (2008) and Sahin (2011) stressed that preservice teachers are more likely to embrace educational technologies if they can see the value of technology in their own specific content areas. This thought is also articulated by Lambert and Gong (2004), who believe that "we must make explicit in our training the 21st century reasons for using technology for teaching and learning" (p. 67).

2.3.3.2 Subject-specific and explicit modeling of technology

According to DeGennaro (2010), the explicit modeling of technology in methods courses motivates teachers to use technology in constructivist and student-centred ways. Chen (2010) also found that teacher candidates were more likely to access and utilize

technology as pedagogical tools in their practicums if the use of technology was supported and encouraged across their teacher education programs. The responsibility of modeling belongs to the faculty instructors and teacher educators, whose own proficiency and attitudes play a critical role in the development of a teacher candidate's technology efficacy (Chen, 2010).

The research exemplifies that teacher candidates benefit from the modeling of technology by their faculty instructors, in addition to authentic experiential learning and explicit instruction (Duncan & Barnett, 2009; Teo et al., 2009). In her 5-year longitudinal study on the work samples and reflections of 223 elementary and secondary preservice teachers in her instruction and technology course, Thieman (2008) found that "teachers tend to use the technologies they were taught" (Thieman, 2008, p. 356). Thieman's preservice teachers were taught how to integrate technology in four areas: (a) planning and designing effective lessons, (b) maximizing student learning, (c) facilitating assessment, and (d) enhancing productivity and professional practice. At the conclusion of the study, 85% of the study's participants had used technology as an instructional tool with their own students based on the tools that they had been exposed to in their preservice program. This statistic emphasizes the continuing need to expose teacher candidates to technology tools and instructional methods in the faculty environment. Teacher candidates will only see the relevance of technology tools if they are modeled by faculty members in their content areas (Sutton, 2011).

2.3.3.3 Providing opportunities for critical reflection

Exposure aside, the literature also emphasizes the need to provide teacher candidates with opportunities for critical reflection on their existing and perceived uses of technology (Chai & Lim, 2011; Duncan & Barnett, 2009; Gao et al., 2009; Gao et al.,

2011; Hammond et al., 2009b; Shoffner, 2009; Teo et al., 2009). Before entering preservice programs, teacher candidates already possess underlying pedagogical beliefs that can (and do) affect the ways that they approach teaching and learning (Chai & Lim, 2011). In Shoffner's (2009) study, students selected a technology medium of their choice to create and maintain reflection journals that focused on classroom practice, student learning, and personal development. By challenging their own beliefs through critical and structured reflection, teacher candidates had the opportunities to assess existing pedagogical strategies and set new goals, in collaboration with their peers and faculty instructors. Students within Shoffner's study also had the opportunity to use technology mediums that they had not used before, although many students ultimately selected familiar and easy-to-use mediums.

2.3.3.4 The importance of faculty knowledge

Thieman (2008) and Gronseth et al. (2010) note that limitations in faculty knowledge must be addressed in order to provide for the effective modeling of educational technologies. Even if there is access to technology in faculties of education, there is often a lack of faculty "training and support for teaching specific technologies to students" (Abner & Lahm, 2002, p. 98). The list of available technologies is extensive and ever-increasing, and technology is prone to rapid evolution (Marino et al., 2009; Smith & Kelley, 2007). While the "digital immigrant" (Prensky, 2001) instructors recognize the importance of technology integration and assistive technology training for educators-in-training, "few [faculty] teachers are adequately prepared to use technology themselves or to help students use technology in the classroom" (Manning & Carpenter, 2008, p. 48). With the issue of essential competencies, many faculty members question what technology content should be delivered to teacher candidates (Smith et al., 2009).

This is especially difficult when we consider that existing "essential" courses (Manning & Carpenter, 2008) contain "other prioritized competencies" (Smith et al., 2009, p. 459) that must be addressed within the strict time confines of the teacher education program.

2.3.3.5 The abbreviated preservice experience

The abbreviated length of the preservice experience is a contentious aspect that often overwhelms arguments of how a teacher education program should incorporate technology. Swabey et al. (2010) comment that "Time is a perennial and internationally recognised problem for teacher education courses" (p. 31). It is argued that it is difficult to develop competence in much of anything in such a short period of time (Bell, Cihak & Judge, 2010; Smith et al., 2009), and there are concerns that teacher candidates may not retain or transfer many of the technology skills and efficacy that they begin to develop in their faculty experiences (Sutton, 2011).

2.3.4 The field experience and mentor modeling

Mentoring by technologically and pedagogically innovative educators serves as an alternative or complementary way for teacher candidates and beginning teachers to experience effective technology integration (Pamuk & Thompson, 2009). Playing a "critical role" in the preparation of teacher candidates (Lambert & Gong, 2004, p. 60), mentoring and field experiences afford teacher candidates the opportunities to observe real classrooms in action. Under the ideal circumstances, field experiences that revolve around effective technology implementation allow teacher candidates to "learn by doing" by observing strategies, raising awareness, and providing models for integrating technology into the classroom by their mentor teachers (Hixon & So, 2009). These types of field experiences also allow teacher candidates to observe and experience "authentic opportunities for practice" (Gronseth et al., 2010, p. 34). These "authentic experiences"

provide opportunities for teacher candidates to synthesize the theoretical technology knowledge that they have acquired within their education programs with real curricula in the field experiences (Chai & Lim, 2011; Sutton, 2011). They also allow teacher candidates to see the application and potential of various technology tools, which can influence the types of technology that teacher candidates will ultimately endorse in their own practices and classrooms (Mueller et al., 2008).

The reviewed literature appears to support the claim that teacher candidates' attitudes and dispositions towards technology are positively affected by supportive field experiences and mentor teachers (Gronseth et al., 2010; Hammond et al., 2011). Starkey (2010) and DeGennaro (2010) argue that teacher candidates need mentors in their subject areas in order to explore pedagogical content knowledge (PCK) that can be synthesized with the otherwise disconnected technological knowledge (TK) that they acquire in the teacher education programs. Because this generation of teacher candidates – digital natives or otherwise – grew up in primarily non-digital classrooms, many do not know "all the possibilities that exist to incorporate technology in the classroom" (Lei, 2009, p. 92), as one teacher candidate noted in Lei's (2009) study. While teacher candidates may be avid users of technology tools outside of school, they have not been exposed to technology as an instructional tool for most of their own experiences as students (Lambert & Gong, 2004), and many teacher candidates have experienced technology, pedagogy, and content independently of one another (Sahin, 2011).

Despite having adequate training and access to technology in some faculties of education, there are instances where teacher candidates are placed in practicum environments with minimal to no support for educational technologies (Chen, 2010; Sutton, 2011). The physical access to technology differs between practicum

environments, and mentor teachers often have very different skill sets and applications for technology (Gronseth et al., 2010). A participant in Hammond et al.'s (2009) study commented that when observing their mentor teacher, "they didn't really use ICT. So at the beginning I was a bit reluctant to use it because I thought that maybe they didn't want me to use it in their class" (Hammond et al., 2009a, p. 68). In cases where the mentor teacher is not modeling technology (either effectively or at all), teacher candidates are left "to take responsibility for their own development" in the application of educational technologies (Hammond et al., 2009a, p. 60). However, many teacher candidates will avoid integrating technology into their practicum experiences because they are concerned about how their instructional approaches will be assessed and evaluated by their mentor teachers (Gao et al., 2010; Gao et al., 2011). When a lack of mentor modeling occurs in practicum environments, DeGennaro (2010) stresses the risk that traditional and non-constructivist models of classroom practice may be perpetuated by the teacher candidate.

2.4 Summary

Before embarking on a study of technology in schools and teacher education programs, it is important to understand how technology exists and continues to evolve in today's world. Perhaps in response to the increased existence and access to various technologies in schools, the roles of teachers (and the instructional tools that they use) are also thought to be evolving. While digital native teachers and teacher candidates are thought to innately understand the numerous pedagogical applications of technology due to their extracurricular and allegedly lifelong technological experiences, much of the literature argues that the digital natives are not prepared to use technologies for student-centred learning practices. If teacher candidates are going to effectively integrate technology into their placements and classrooms, it is important to recognize the teacher

candidate population as a heterogeneous group of individuals who are influenced by (1) their context, (2) their own lived experiences and attitudes, (3) their teacher education programs and faculty instructors, and (4) their field placements and mentor teachers. This study builds on the reviewed literature by analyzing how a subsample of teacher candidates were encouraged or dissuaded to use technology in their teacher education program and field placements through the intersection of multiple situational, institutional, and dispositional variables.

CHAPTER III

METHODOLOGY

3.1 Research design

This study utilized a mixed methods design (Creswell, 2005) to investigate the situational, institutional, and dispositional factors that can affect the relationship between the preservice curriculum in technology and the classroom realities that are met by the teacher candidates in their practicum experiences. Over a two-week period in January 2012, quantitative and qualitative data were collected simultaneously through questionnaires, semi-structured interviews, and curriculum documents from the required technology course, and then merged to understand the scope of the research problem (Creswell, 2005). A mixed methods design allows researchers to examine whether the results from the quantitative data support or contradict the results from the qualitative data (and vice versa), and discuss themes that emerge from both sets of data to have them triangulated (Creswell, 2005). It also gives researchers the opportunity to utilize the strengths in one data collection form to offset any weaknesses that exist in the other collection form (Creswell, 2005). The combined approach (Brannen, 1995) employed in this study consisted of questionnaires with quantitative and qualitative questions, and qualitative semi-structured interviews. The quantitative questionnaire questions were closed-ended and yielded numeric data scores, while the qualitative questions were open-ended and yielded text-based data. The semi-structured interview data were also qualitative and text-based after transcription of the audio recordings.

While problems have been identified within this type of mixed methods research, it is becoming more common and increasingly relevant in the field of educational

research (Brannen, 1995). The argument has been made that a triangulation data analysis can yield inconsistent findings between data forms, but Brannen (1995) suggests that we can use "inconsistent findings as suggestive of new lines of enquiry" (p. 64). Mixed methods research includes "*numbers* that define the scope and patterns of the problem, and a *story* that shows how the problem works in daily life and provides for empathetic understanding" (Spalter-Roth, 2000, p. 48). In this study, qualitative data collected from the interviews and the questionnaires were just as important as the quantifiable questionnaire data. The qualitative aspects of the study allowed me to explore the experiences of teacher candidates in greater depth than some of the closed-ended questions in the questionnaire, while the quantitative aspects of the study provided me with numerical trends and variables amongst the participants that could be compared to findings in existing studies.

3.2 Literature sources

This study sampled information from a broad source of scholarly journals, books, Faculty of Education websites, syllabus documents, and technological guidelines for teaching and learning. To pursue research in this area, I used the Education Resources Information Center (ERIC) to find relevant, peer-reviewed articles, and Leddy Library to access the journals online. The most popular keywords in my literature search are presented in Figure 3, a Wordle that was constructed from the most common themes and keywords in the scholarly articles that were used in this study. The size of the word is directly related to the number of times it is found in the articles' identifiable keywords - the larger the word, the more times it appeared within the keyword search.

Figure 3. Literature search Wordle.

I allowed a generous time period for the publication time of the scholarly articles, ranging from 1989 to 2012. This allowed me to examine recurring themes within the existing literature, as well as the overall pace of technological integration into teacher education programs and field placements. The majority of the referenced sources were gathered before collecting the data, but I also continued reading timely material as I analyzed the data and finalized the study.

While technology integration policies are varied according to geographical locations, I chose to use articles from multiple international locations that have access to similar technologies. By examining multiple locations, I was able to explore how different teacher preparation programs are introducing technology, allowing myself to gain a better perspective of the implementation challenges and recommendations faced by educators around the world.

In order to broadly compare how technology is utilized within the studied teacher education program compared with other teacher education programs in Ontario, I used the

Ontario College of Teachers faculty search (OCT, 2011b) to examine technology courses offered in 2011-2012 in all of the consecutive teacher education programs in Ontario. To confirm the data on the faculty websites, I sent emails to each of the programs with the following questions:

- Does your Faculty of Education have **required** courses pertaining to technology?
- Does your Faculty of Education have **elective** courses pertaining to technology?
- What kind of professional development has been/will be offered to 2011-2012 Faculty of Education students?

The data collected from these inquiries can be found in Appendix A.

3.3 Participant selection

Purposeful sampling was used to collect data in this study. Purposeful sampling occurs when "researchers intentionally select individuals and sites to learn or understand the central phenomenon" (Creswell, 2005, p. 204). In this study, the students in the J/I and I/S sections of the learning technologies class (the individuals) were purposefully sampled from the 2011-2012 Consecutive Bachelor of Education class within the Faculty of Education (the site). Because the sample is so specific to one part of a larger population, the study is not meant to represent or generalize the wider population (Basit, 2010).

The sample consisted of consecutive Bachelor of Education teacher candidates from five sections of a required learning technologies class in a teacher education program in Ontario. Within the five sections, one hundred sixty-seven teacher candidates were eligible to voluntarily participate in the study. Two of the sections were

Junior/Intermediate (J/I), and three of the sections were Intermediate/Senior (I/S). At the time of the data collection, all teacher candidates had completed a four-week placement. All J/I participants had one teachable subject and could teach grades 4 to 10, while all I/S participants had two teachable subjects and could teach grades 7 to 12.

The learning technologies class is held once a week for fifty minutes, and the same instructor teaches each of the five sections. The class description for both the J/I teacher candidates and I/S candidates is as follows:

> This course is designed to explore a range of digital technologies in educational settings. Focusing on teaching, learning and inquiry, students will evaluate digital educational resources, critically discuss and assess uses of new media in school-based contexts, gain hands-on experiences with various digital tools, and develop various multimedia instructional tools with the aim of building an intelligent and thoughtful disposition towards the use of multimedia tools within their own classroom and school contexts. (Zhang, 2011a/b, p.1)

In this class, students are assessed based on class participation (20%), technology workshops (referred to as "tech workshops" in the class) (20%), discussions on required readings (15%), online discussions (15%), and final projects (30%).

3.4 Data collection

Data for this study was collected through a questionnaire, semi-structured interviews, and the course syllabi with the intention of gathering information on the situational, institutional, and dispositional variables that can affect the relationship between the preservice curriculum in technology and the classroom realities that are met by the teacher candidates in their practicum experiences. Data was collected over a two-week period in January 2012. Teacher candidates began their second placement on

January 30, and this placed strict timelines on when data could be collected.

3.4.1 Recruitment and general procedures

Approval to conduct the study was granted by the Research Ethics Board, the Dean of the Faculty of Education (Appendix B), and the professor of the preservice learning technologies class. In early January 2012, I visited the five sections at the beginning of each of their classes and distributed a total of 140 packages that contained letters of information (Appendix C), consent forms (Appendix D), and questionnaires (Appendix E). A brief presentation was prepared to explain the purpose of the study (Appendix F), the contents of the packages, the procedures involved, the potential risks and benefits, participant compensation, confidentiality, participant withdrawal, and how participants would receive feedback on the results of the study. Prospective participants were told that the study was being conducted to fulfill a thesis requirement; their participation in the study was entirely voluntary, and teacher candidates were not required to return the questionnaires if they chose not to participate. During my visit, teacher candidates who were interested in participating in focus groups or interviews wrote down their contact information. After my visit, I contacted the individual teacher candidates to create an interview schedule. The teacher candidates were given two weeks to complete the questionnaires and participate in interviews, outside of class time.

3.4.2 Questionnaires

A questionnaire was one of the preferred methods in the study because it allowed me to compare and contrast the characteristics and experiences of the teacher candidate population in a relatively short amount of time (Nardi, 2006). The questionnaire contained a mixture of closed-ended and open-ended questions (Tashakkori & Teddlie, 1998); in order to not limit the closed-ended responses (Nardi, 2006), space was provided

after each question for the participants to make notes or explain their responses. The questionnaire collected information from the teacher candidate in the following areas: (1) the teacher candidate's demographic information and perceived technological efficacy; (2) the teacher candidate's access to and use of various technologies at home; (3) the teacher candidate's experiences with technology in the Faculty of Education, above and beyond the learning technologies class; (4) the teacher candidate's experiences with technology in the learning technologies class; and (5) the teacher candidate's experiences within their first placement and their overall attitudes towards various issues that pertain to emerging technologies. By distributing an anonymous survey, I allowed a larger population of respondents to answer as candidly as they wished, and at their leisure. Had I only conducted face-to-face interviews or focus groups, the size of my data may have been significantly reduced. In this particular study, questionnaires allowed for increased standardization in the teacher candidate responses. Unlike the face-to-face interviews, I was not present to clarify certain questions or influence responses (Nardi, 2006).

140 questionnaires were self-administered to teacher candidates within five sections of the Learning with Technologies course. The questionnaires were to be voluntarily completed outside of class time and returned two weeks after being administered, whereupon I would pick up and immediately separate the signed consent forms and anonymous questionnaires to maintain participant anonymity. During the two-week period, teacher candidates were electronically reminded to complete their questionnaires in the announcements section on their class' website. After the two-week period, thirty-two teacher candidates returned questionnaires for a final response rate of 22.85%.

3.4.3 Interviews

Interviews were selected as an additional tool for data collection. Interviews are not concerned with generalizing information from the findings, but rather act as a measure for what an individual knows (knowledge or information), what an individual likes or dislikes (values and preferences), and what a person thinks (attitudes and beliefs) (Basit, 2010, p. 100). Interviews were a complementary extension to the questionnaires because of "teachers' reluctance to put on paper what they revealed freely in their oral remarks" (Creswell, 2005, p. 515). Interviews were conducted over the same two-week period that was given to the teacher candidates to complete the questionnaire. I initially wanted to conduct one focus group with five to seven teacher candidate participants, but I had to adapt my methodology to accommodate the busy schedules of the teacher candidates before they embarked on their second placement of the academic year. In retrospect, the interviews were preferred to the focus group simply because they provided me with more intimate portraits of the participants. I conducted two one-on-one interviews, as well a two-person interview, for a total of three interviews and four participants. Each interview lasted between forty-five minutes and one hour.

Teacher candidates who were interested in focus groups or interviews were contacted by email, and an interview schedule was determined. Based on this schedule, available rooms were booked within the Faculty of Education. At the beginning of each scheduled interview, teacher candidate participants were reminded of the purpose of the study, the individuals and sources of data being collected, what would be done with the data to protect the confidentiality of the participants, and the approximate length of the discussion. After the teacher candidates read and signed the Audio Consent form (Appendix G), the audio recorder was turned on and tested.

When I conducted the interviews, I brought a digital recorder, my laptop computer for audio recording and making notes, and a notebook as an alternative tool for recording notes. I used a digital recorder in addition to a recording program on my computer to ensure that the interviews were recorded. While the interview participants talked, I made notes on a fieldnotes template (Appendix H) and created additional questions.

During the semi-structured interviews, the participants were asked to provide their impressions on (1) the teacher candidate's placement experiences, (2) the teacher candidate's experiences in the learning technologies class, and (3) the teacher candidate's experiences with technology in the broader Faculty of Education. More general questions pertaining to the individual's dispositions toward technology were interspersed between the aforementioned thematic areas (Appendix I). I prepared a number of questions in advance, but the questions were created as thematic guidelines that were constructed to complement the content that existed in the questionnaire. Because of the one-on-one and one-on-two settings, I had more flexibility to engage with the individual participants and elicit their thoughts and feedback on their experiences within the program and their placements. The semi-structured interview format also allowed me to create supplementary questions as the interviewees responded. Some questions that I had prepared in advance became redundant as the interviewees reflected on their experiences, and the semi-structured format allowed me to ask things out of sequence or not at all (Basit, 2010).

Interviews were a complementary extension to the questionnaires, as they were able to "illuminate certain phenomena" (Basit, 2010, p. 100). Unlike the questionnaire, which was completed individually, the interviews were co-constructed and interactive, with opportunities for the participants to ask their own questions or seek clarification

(Basit, 2010). Whereas questionnaire participants were able to skip through questions, interview participants seemed very willing to engage in oral dialogues about their experiences with technology.

3.5 Data Analysis

3.5.1 Questionnaires: quantitative data

IBM SPSS Statistics 20 was used to input, score, and analyze the quantitative and closed-ended data derived from the questionnaire. The frequencies and percentages of closed-ended responses were calculated, and frequency tables were created. Where appropriate, crosstabulation tables were created to compare various portions of the data with (a) participants' perceived overall technological abilities, (b) participants' genders, and (c) participants' years of birth. All bar charts and scatterplots were created in Excel by importing specific variable data from SPSS. These figures were used to present relationships that existed among certain variables (Creswell, 2005). The quantitative findings are presented in the following chapter.

3.5.2 Questionnaires: qualitative data

Text-based and open-ended responses were transcribed in Microsoft Word and subsequently categorized and colour-coded in Microsoft Excel according to (a) the question itself, and (b) a theme identified with the participant's quote (e.g., faculty instructor modeling). Where possible, the qualitative data was quantified to present frequencies. Through direct quotations from teacher candidates, recurring variables, themes, and frequencies, the qualitative data were used to support the quantitative questionnaire data.

3.5.3 Interviews: qualitative data

The interviews were recorded on a digital recorder as well as basic audio

recording software on my laptop. After converting the files to MP3s, I transcribed the interviews using Microsoft Word. I then coded the data according to themes that were identified most frequently in the questionnaire data, since the majority of the interview data elaborated on the existing questionnaire data. The interview data were then integrated into the questionnaire data, which is presented in the following chapter.

3.6 Ethical considerations

After being notified of the purpose of the study, participants volunteered to be involved in the questionnaire and interviews involved in the study. Teacher candidates were able to withdraw at any time without consequences of any kind. They were also given the right to refuse to answer any questions that they did not want to answer in the questionnaire or interviews and still remain in the study. Any withdrawal from the questionnaire had to be done before the questionnaire was submitted, as the questionnaires were considered anonymous and did not contain any identifiers or names. Interview participants were able to leave the room before, during, or after the discussion, but were informed that they could not withdraw data from any of the recordings.

Upon submission, the completed teacher candidate questionnaires were immediately separated from the consent forms to protect the anonymity of the participants. After confirming that there were no identifiers (such as names) on the questionnaires, the questionnaires were then coded by number from 1 to 32 (N = 32). Teacher candidates who participated in the semi-structured interviews were also given numbers in the transcripts. If names or schools were mentioned in interviews, these names were changed in the transcripts to protect the anonymity of the participants. Interview participants were also obligated to sign an audio consent form before recording began.

To ensure confidentiality of the participants during the conduct of the research and dissemination of the results, I was the only individual with access to the raw data (the questionnaires and the interview transcripts). Data was electronically secured/encrypted and physically locked in a secure cabinet/room when not in use. To further protect the anonymity of the participants, the instructor of the learning technologies course was not given access to the raw data at any point in the study. Raw data will be kept under my possession until this study has been successfully defended.

CHAPTER IV

ANALYSIS OF RESULTS

The data in this study were collected with the intention of understanding how a very specific sample of teacher candidates were encouraged or inhibited to integrate technology into their teaching and learning practices. This chapter will present the findings according to the following broad categories: (1) the teacher candidates, (2) technology within the faculty of education, and (3) technology within the field experience.

4.1 The teacher candidates

Data gathered from the questionnaires and interviews are presented in sections 4.1.1-4.1.5. These sections provide a brief biographical overview of the participants, a summary of their perceived abilities with technology, an examination of their extracurricular uses of technology, their self-reported technological goals, and their overall attitudes and beliefs towards technology in education.

4.1.1 Biographical overview

A biographical overview of the participants is included in Table 1, which summarizes the participants' genders, years of birth, divisions, teachable areas, previous degrees, and perceived overall abilities with technology.[1] The sample included thirty-two teacher candidates (Junior/Intermediate division [N = 16] and Intermediate/Senior division [N = 16]) from a consecutive teacher preparation program in Ontario who were

[1] The reviewed literature does not address ethnic origin as a potential variable that could affect technology integration. While demographic data was collected about participants' ethnic origins and backgrounds, it will not be included in this data analysis.

required to take a learning technologies course as part of their degree. Using a frequency distribution, the sample consisted of twenty-five (78.1%) female teacher candidates and seven (21.9%) male teacher candidates. The Junior/Intermediate division participants included thirteen females and three males; the Intermediate/Senior division participants included twelve females and four males.

Participants were born between 1973 and 1990 (range = 17 years), but the majority of the participants (n = 31, 96.9%) were born between 1982 and 1990. The outlier (Participant 20) was born in 1973, but remained in the data analysis because she represented a non-digital native, otherwise known as a digital immigrant.

The most popular teachable areas in the Junior/Intermediate division were English (25.0%) and History (25.0%). Twelve teacher candidates (37.5%) did not have a second teachable. The most popular teachable areas in the Intermediate/Senior division were Biology (18.7%), English (15.6%), and Math (12.5%). All Intermediate/Senior teacher candidates were required to have two teachable areas.

15.6% of the sample had completed at least one undergraduate major or minor in English Literature, followed by History (7.8%). Four participants (12.5%) had completed Master's degrees prior to their admission in the teacher preparation program.

Table 1: Teacher candidate biographical information			
Variable	Category/Response	Frequency	Percent (%)
Gender	Female	25	78.1%
	Male	7	21.9%
Year of birth	1973	1	3.1%
	1982	1	3.1%
	1983	1	3.1%
	1984	1	3.1%
	1986	5	15.6%
	1987	4	12.5%
	1988	5	15.6%
	1989	12	37.5%
	1990	2	6.3%
Division	Junior/Intermediate	16	50.0%
	Intermediate/Senior	16	50.0%
Junior/Intermediate teachable areas	English	8	25.0%
	History	8	25.0%
	Social Sciences	2	6.3%
	Visual Arts	2	6.3%
	No second teachable	12	37.5%
Intermediate/Senior teachable areas	Biology	6	18.7%
	Chemistry	2	6.3%
	Computer Science	1	3.1%
	Drama	1	3.1%
	English	5	15.6%
	French	1	3.1%
	History	3	9.4%
	Individual & Society	1	3.1%
	Math	4	12.5%
	Music	3	9.4%
	Physical Education	2	6.3%
	Physics	3	9.4%

Table 1 (continued): Teacher candidate biographical information			
Variable	Category	Frequency	Percent (%)
Previous degrees	Applied Science	1	1.6%
	Art History	1	1.6%
	Biochemistry	1	1.6%
	Biological Sciences	1	1.6%
	Biology	1	1.6%
	Communication Studies	1	1.6%
	Computer Science	1	1.6%
	Creative Writing	1	1.6%
	Developmental Psychology	1	1.6%
	Drama	1	1.6%
	Engineering	1	1.6%
	English Literature	10	15.6%
	French	1	1.6%
	General Science	1	1.6%
	Geography	1	1.6%
	German	1	1.6%
	High Tech	1	1.6%
	History	5	7.8%
	Human Kinetics	1	1.6%
	International Relations	1	1.6%
	Kinesiology	1	1.6%
	Math	1	1.6%
	Medical Engineering	1	1.6%
	Music	3	4.7%
	Physical Education	1	1.6%
	Physics	1	1.6%
	Psychology	2	3.1%
	Sociology	2	3.1%
	Spanish	1	1.6%
	Statistics	1	1.6%
	Visual Arts	3	4.7%
	No second major/minor	14	21.9%
Master's Degree	Yes	4	12.5%
	No	28	87.5%
Total number of participants		**32**	**100%**

4.1.2 Participants' perceived abilities with technology

Table 2a presents the findings for teacher candidates' perceptions of their own technological abilities. Nineteen participants (59.4%) reported that they could use technology at any time without assistance, while eleven participants (34.4%) reported that they could use technology with minimal assistance. There were no reports of participants being unable to use technology without assistance. The definitions of "technology" and "assistance" were not defined in the questionnaire, and it was up to each participant to select his or her perceived ability. When asked about their overall ability using technology, Participants 20 and 31 said that they could use technology without assistance, but needed time to explore "new" software before being comfortable enough to use regularly and without assistance. Participant 17, who could use technology with minimal assistance, expanded on this: "I need minimal assistance when using technology – I am somewhat oriented to using programs in Microsoft office, websites such as Prezi, Facebook, however, it takes me quite a while to learn how to use a new website or computer program (iMovie, Bitstrips.com, etc.)."

Table 2a: Teacher candidates' perceptions of technological ability			
Variable	Category	Frequency	Percent (%)
Perceived overall ability with technology	I can use technology without assistance at any time.	19	59.4%
	I need minimal assistance when using technology.	11	34.4%
	I need a lot of assistance when using technology.	2	6.3%
	I cannot use technology without assistance.	0	0.0%
Total number of participants		**32**	**100.0%**

Table 2b contrasts the teacher candidates' years of birth with their perceived technological abilities. The outlier (year of birth = 1973) – the *non*-digital native – identified herself as being able to use technology without assistance at any time. The only two participants to identify themselves as needing a lot of assistance when using technology were both born in 1989, which would put them into the digital native category. More "digital-immigrant" participants would be needed to draw any conclusions from the data.

Table 2b: Year of birth * Overall technological ability Crosstabulation

		Overall technological ability			Total (N)
		I need a lot of assistance when using technology (N)	I need minimal assistance when using technology (N)	I can use technology without assistance at any time (N)	
Year of birth	1973	0	0	1	1
	1982	0	0	1	1
	1983	0	1	0	1
	1984	0	0	1	1
	1986	0	2	3	5
	1987	0	1	3	4
	1988	0	2	3	5
	1989	2	4	6	12
	1990	0	1	1	2
Total		**2**	**11**	**19**	**32**

Gender was examined in relation to perceived technological ability, and the findings are presented in Table 2c. It is difficult to generalize the data because of the numerical inequities between females who completed the questionnaire (n = 25) and males who completed the questionnaire (n = 7), as well as the small overall sample size, but differences between perceived technological abilities are quantifiably evident between the males and females in this sample. The two participants who identified themselves as needing a lot of assistance when using technology were both female. 52.0% of females identified themselves as being able to use technology without assistance at any time, versus 85.7% of male participants.

Table 2c: Gender * Overall technological ability Crosstabulation

		Overall technological ability						Total	
		I need a lot of assistance when using technology		I need minimal assistance when using technology		I can use technology without assistance at any time			
		(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
	Female	2	8.0	10	40.0	13	52.0	25	100.0
	Male	0	0.0	1	14.3	6	85.7	7	100.0
Total		**2**	**8.0**	**11**	**54.3**	**19**	**137.7**	**32**	**200.0**

4.1.3 Teacher candidates' extracurricular uses of technology

Table 3a presents an overview of the participants' extracurricular uses of technology, including the types of electronic and communication devices they had access to at home, the number of computers in their household, whether or not they had home Internet access, and hours per day of home Internet use.

All of the participants (N = 32) had access to the Internet at home, although the type of access (wireless, dial-up, mobile) was not specified. Eighteen participants (56.3%) had access to cell phones with Internet access, and nineteen participants (59.4%) used a designated smartphone. Twenty-five participants (78.1%) used an MP3 player, while only five participants (15.6%) had access to a tablet device.

The number of household computers ranged from 0 to 7, with the average participant having access to three computers in their household, as presented in Table 3b's findings. While one participant mentioned that they did not have a household computer, 100.0% of the participants had one or more laptop computers available at

home. Between the thirty-two participants, there were a total of eighty-nine desktop and/or laptop computers.

Table 3c examines the hours per day of home Internet use for extracurricular use and schoolwork-related use, and provides the mean, median, mode, and sum for these figures. Each teacher candidate spent an average of 3.4 hours per day on the Internet, with an average of 2.0 hours dedicated to schoolwork. The total number of hours per day amongst the thirty-two participants was 109.0 hours, with 65.0 hours dedicated to schoolwork. Figure 4 provides a more detailed summary of participants' daily Internet use in relation to their year of birth. There were no identifiable trends between year of birth and hours spent online per day.

Table 3a: Teacher candidates' extracurricular uses of technology (overview)

Variable	Response	Frequency	Percent (%)
Access to electronic and communication devices (at home)	*Cell phone without Internet*		
	Yes	14	43.8%
	No	18	56.3%
	Smartphone		
	Yes	19	59.4%
	No	13	40.6%
	Desktop computer		
	Yes	20	62.5%
	No	12	37.5%
	Laptop computer		
	Yes	32	100.0%
	MP3 player		
	Yes	25	78.1%
	No	7	21.9%
	Tablet device		
	Yes	5	15.6%
	No	27	84.4%

Table 3a (continued): Teacher candidates' extracurricular uses of technology (overview)			
Variable	Response	Frequency	Percent (%)
Number of household computers	None	1	3.1%
	1	3	9.4%
	2	8	25.0%
	3	15	46.9%
	4	2	6.3%
	5	2	6.3%
	7	1	3.1%
Home Internet access	Yes	32	100.0%
Hours/day of home Internet us	2.0 hours	13	40.6%
	3.0 hours	7	21.9%
	4.0 hours	6	18.8%
	5.0 hours	2	6.3%
	6.0 hours	3	9.4%
	10.0 hours	1	3.1%
Hours/day of Internet use for schoolwork or practicum preparation:	.00 hours	1	3.1%
	.33 hours	1	3.1%
	.50 hours	1	3.1%
	1.00 hours	6	18.8%
	1.50 hours	7	21.9%
	1.75 hours	1	3.1%
	2.00 hours	6	18.8%
	2.50 hours	2	6.3%
	3.00 hours	4	12.5%
	4.00 hours	1	3.1%
	5.00 hours	1	3.1%
	8.00 hours	1	3.1%

Table 3b: Teacher candidates' extracurricular uses of technology: Number of household computers	
Mean	2.7813
Median	3.0000
Mode	3.00
Sum	89.00

Table 3c: Teacher candidates' extracurricular uses of technology: Internet		
	Hours/day of home internet use	Hours/day of internet use for schoolwork
Mean	3.4063	2.0338
Median	3.0000	1.6250
Mode	2.00	1.50
Sum	109.00	65.08

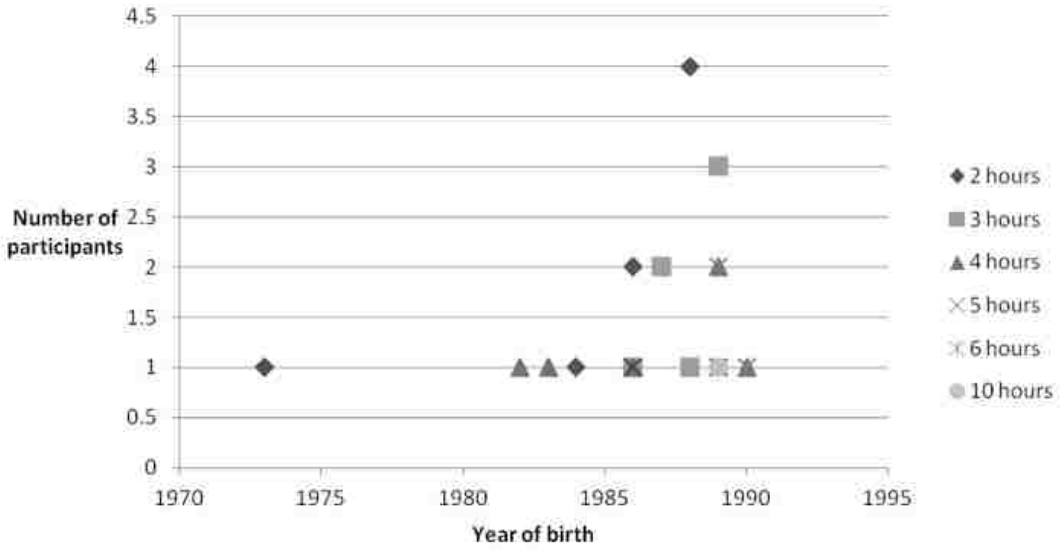

Figure 4. Comparison of year of birth and overall daily Internet use.

Table 3d summarizes how teacher candidates used their mobile devices. 100.0% of the participants used their cell phones to make calls and send/receive text messages. Roughly half of the participants used their mobile devices for more than phone calls and text messages, as presented in the table. Participants who selected "Other" mentioned that they used their cell phones and smartphones as an alarm clock, a calculator, a digital organizer, a picture video and video recorder, and an audio recorder for "recording musical ideas."

Participant 12, who did not have a smartphone, said that she used her iPod Touch for functionalities otherwise associated with a smartphone: "I use my iPod Touch to send and receive texts, emails, access the Internet, access social networking sites, play games, listen to music, etc." It can be inferred that access is no longer device-specific, and teacher candidates are connected across a variety of physical and digital platforms.

Table 3d: Teacher candidates' extracurricular uses of technology: Cell phones

Variable	Response	Frequency	Percent (%)
Cell phone is used to:	*Make phone calls*		
	Yes	32	100.0%
	Send/receive text messages		
	Yes	32	100.0%
	Send/receive instant messages		
	Yes	13	40.6%
	No	19	59.4%
	Send/receive emails		
	Yes	13	40.6%
	No	19	59.4%
	Access the Internet		
	Yes	19	59.4%
	No	13	40.6%
	Access social networking sites		
	Yes	17	53.1%
	No	15	46.9%
	Play games		
	Yes	19	59.4%
	No	13	40.6%
	Play, listen, and view multimedia		
	Yes	20	62.5%
	No	12	37.5%

Table 3d (continued): Teacher candidates' extracurricular uses of technology: Cell phones			
Variable	Response	Frequency	Percent (%)
Cell phone is used to:	*Post multimedia*		
	Yes	7	21.9%
	No	25	78.1%
	Other		
	Yes	2	6.3%
	No	30	93.7%

Table 3e summarizes the findings pertaining to the participants' uses of computers and cell phones. 100.0% of the participants (N = 32) used their at-home devices to work on assignments. Thirty-one participants (96.9%) using their at-home devices to work on school presentations, with the same amount of participants participating in online/collaborative projects. Thirty participants (93.8%) used computers or cell phones to create and share content with peers, share multimedia files, and use social networking sites. Only one participant (3.1%) participated in a virtual world, such as Second Life, but sixteen participants (50.0%) played online interactive games.

Three participants (9.4%) selected "Other." Other identifiable uses for computers or cell phones among the participants included editing videos, creating posters, researching, watching movies, checking news, watching television programs, watching YouTube videos, and recording and notating music. It is very likely that more than 9.4% of participants engage in one or more of these other uses.

Table 3e: Teacher candidates' extracurricular uses of technology: Uses of computers and cell phones

Variable	Category	Frequency	Percent (%)
Computers or cell phones have been used this year at home to:	*Participate in online/collaborative projects*		
	Yes	31	96.9%
	No	1	3.1%
	Create/share content with my peers		
	Yes	30	93.8%
	No	2	6.3%
	Collaborate on wikis		
	Yes	14	43.8%
	No	18	56.3%
	Create polls or surveys		
	Yes	4	12.5%
	No	28	87.5%
	Blog		
	Yes	8	25.0%
	No	24	75.0%
	Participate in virtual worlds		
	Yes	1	3.1%
	No	31	96.9%
	Build a website		
	Yes	11	34.4%
	No	21	65.6%
	Share multimedia files		
	Yes	30	93.8%
	No	2	6.3%
	Play interactive games		
	Yes	16	50.0%
	No	16	50.0%

Table 3e (continued): Teacher candidates' extracurricular uses of technology: Uses of computers and cell phones			
Variable	Category	Frequency	Percent (%)
Computers or cell phones have been used this year at home to: (continued)	*Use social networking websites* Yes No *Participate in chat rooms* Yes No *Work on assignments* Yes *Create presentations* Yes No *I have not used the Internet at home* No *Other* Yes No	 30 2 8 24 32 31 1 32 3 29	 93.8% 6.3% 25.0% 75.0% 100.0% 96.9% 3.1% 100.0% 9.4% 90.6%

Table 3f compares the social networking uses of the participants at home to the social networking uses of the participants in their first placements. Twenty-nine participants (90.6%) used Facebook on a regular basis, but only one participant (3.1%) had used the website in their placement. YouTube was the most popular social networking website to be used by participants in their placements (n = 23, 71.9%), with twenty-eight participants (87.5%) also using this website on a regular basis at home.

There was a significant statistical difference between YouTube and the other websites. While YouTube is a social networking platform where users can upload, share, interact with, and view content created by themselves and others in the realm of Web

2.0,[2] many of the participants in this study were viewing YouTube videos for the purposes of complementing their lessons. There is less of an onus on YouTube users and visitors to upload content and interact with others.

The table displays frequencies that suggest the participants were producing online content in addition to consuming it. Twenty-five participants (78.1%) had posted content on Facebook, eleven participants (34.4%) had posted content on Twitter, and ten participants (31.3%) had posted content on YouTube.

In one of the interviews with two I/S participants (P2 and P3), they were asked how they felt about the possibility of integrating social networking into their own classrooms. Both participants appeared conflicted about the positive and negative contributions of social networking in schools:

> P2: We talked about using Twitter in one of our faculty classes, where we actually started a Twitter account.
>
> P3: I think that if you have a blog too, specifically for your class, through the school's website or something, I think that could be good.
>
> P2: I'm trying to think of how I could use Facebook.
>
> P3: I don't think there's any positive way to use it.
>
> P2: And just because you can't really monitor it. Like on Facebook, you can get to so many people's different things. Same with Twitter. You can get to anybody's Twitter account. You just can't guess what they're going to write, like if it's going

[2] According to Chau (2010), "YouTube lies at the intersection of media creation and social networking, providing young people a participatory culture in which to create and share original content while making new social connections" (p. 65).

> to be full of profanity and, I don't know, just bad things. Bad videos, bad pictures, things like that.

While the interview participants were encouraged by the faculty to use a form of social networking (Twitter) in their classrooms, they were concerned over the existence of "bad" content beyond the school's approved network(s) that they could not monitor. The quantifiable differences between extracurricular-uses of social networking websites compared to in-school-uses of social networking websites in Table 3f may be attributed to this apprehension.

The topic of social networking also surfaced in two other individual interviews with I/S participants. P1 addressed the parental concern involved in a teacher's decision to bring social networking into the classroom:

> It's not necessarily what they'll be accessing but more that the access is there and that it's open. Let's not even mention what parents would think about that. I think that would be a bigger problem. They put so much responsibility on schools now that parents would blame schools if something went wrong with open access. I think the best thing is to not have it open.

P4 approached the issue of social networking websites from a more pragmatic and teachable perspective:

> I think that they should have open access to the Internet and then you should use it as a teaching tool. Like, how do you use the Internet responsibly when you have open access to the Internet? You have responsible uses, irresponsible uses, what are the consequences of using the internet irresponsibly…because I think blocking certain sites is kind of making a fake world. When they go home, I guess there are software programs that can block certain sites, but even in that case, what are you

> teaching them? You're not really teaching them anything. You're just restricting them. You're not informing them.

Section 4.3.1 will examine the specific websites that were used by the participants in their first placements.

Table 3f: Teacher candidates' extracurricular uses of technology: Social networking habits at home vs. in placement

Variable	Category	Frequency	Percent (%)
Facebook	*I use this website regularly.*		
	Yes	29	90.6%
	No	3	9.4%
	I have posted content on this site.		
	Yes	25	78.1%
	No	7	21.9%
	I have used this site in my practicum.		
	Yes	1	3.1%
	No	31	96.9%
Twitter	*I use this website regularly.*		
	Yes	8	25.0%
	No	24	75.0%
	I have posted content on this site.		
	Yes	11	34.4%
	No	21	65.6%
	I have used this site in my practicum.		
	Yes	1	3.1%
	No	31	96.9%
YouTube	*I use this website regularly.*		
	Yes	28	87.5%
	No	4	12.5%
	I have posted content on this site.		
	Yes	10	31.3%
	No	22	68.8%
	I have used this site in my practicum.		
	Yes	23	71.9%
	No	9	28.1%

Table 3f (continued): Teacher candidates' extracurricular uses of technology: Social networking habits at home vs. in placement

Variable	Category	Frequency	Percent (%)
MySpace	*I use this website regularly.*		
	No	32	100.0%
	I have posted content on this site.		
	Yes	3	9.4%
	No	29	90.6%
	I have used this site in my practicum.		
	No	32	100.0%
LinkedIn	*I use this website regularly.*		
	Yes	2	6.3%
	No	30	93.8%
	I have posted content on this site.		
	Yes	2	6.3%
	No	30	93.8%
	I have used this site in my practicum.		
	No	32	100.0%
Blogs	*I use this website regularly.*		
	Yes	6	18.8%
	No	26	81.3%
	I have posted content on this site.		
	Yes	6	18.8%
	No	26	81.3%
	I have used this site in my practicum.		
	Yes	2	6.3%
	No	30	93.8%

Table 3f (continued): Teacher candidates' extracurricular uses of technology: Social networking habits at home vs. in placement			
Variable	Category	Frequency	Percent (%)
Other	*I use this website regularly.*		
	Yes	2	6.3%
	No	30	93.8%
	I have posted content on this site.		
	No	32	100.0%
	I have used this site in my practicum.		
	Yes	1	3.1%
	No	31	96.9%

4.1.4 Participants' goals for using technology in the classroom

Question 3.8 in the questionnaire asked participants about their goals for using technology in the classroom. Teacher candidates' goals for using technology in the classroom were coded into the following categories: (1) to engage students in active, interactive, and relevant learning; (2) to engage students in differentiated learning; (3) to learn and use new instructional tools; and (4) to use technology sparingly, in moderation, and only when relevant.

(1) Engage students in active, interactive, and relevant learning

Most of the participants wanted to use technology as a way to engage students in the curriculum in interactive and "new" ways. Participant 10 discussed the importance of using technology to increase student productivity and to develop effective communication skills, in addition to teaching students the "multimodal technology skills to be effective citizens in the 21st century." Participants 24 and 31 commented on the importance of using technology in the classroom to complement students' familiarity with technology

outside of the classroom. Participant 31 also wanted to use technology as a way to "help my students make connections between what they learn in the classroom and the real world."

(2) Engage students in differentiated learning

Only three questionnaire participants explicitly mentioned technology as a tool that could be used to promote differentiated teaching and learning. Participant 1 specifically mentioned technology as a means to promote "visual, audio, and kinetic learning." The other participants mentioned technology as a way to modify or change the delivery of lessons, depending on students' needs and learning styles.

Interview participants P2 and P3 were excited about the potential of technology tools in their science classrooms. When asked if technology could be used to enhance teaching and learning, P3 said, "Yes, especially in science. Because there are some things you can't see – like you can't see what the inside of a cell looks like under a microscope, and you can't see the mitochondria…it's easier to use simulations." P2 also commented on the ease of using technology for simulations of mice breeding: "I just clicked "breed" and it gave us the offspring right away, of what it would be and what their genotype would be. So the students can do an experiment that would usually take years in twenty-five minutes." From making inquiry-based simulations to having students design their own experiments, P2 and P3 saw the value in having ready access to technology in science classrooms.

(3) Learn and use new instructional tools

The majority of respondents appeared motivated to continue learning about emerging technology tools that could be used to promote effective teaching and learning in their classrooms. Several participants commented that they wanted to "stay up to date"

with emerging technologies and implement instructional tools as much as possible. Many of the participants in this category expressed a desire to become more comfortable and proficient with the SMART Board and its many uses. Other tool-specific goals included becoming more comfortable with Web 2.0 tools, creating class websites, incorporating more Webquests into lesson plans, letting students use their own mobile devices in class, and having students submit assignments online.

(4) Use technology sparingly, in moderation, and only when relevant

While most of the respondents were enthusiastic in stating their goals, several participants were more critical of the use of technology in alignment with their pedagogical goals. These participants commented that technology is not always required or necessary; as such, their goals were to use technology sparingly and in moderation. Participant 18 discussed the need for teachers to be critical of the tools that they use, and said, "I intend to use technology when it's appropriate and relevant to my lessons to enhance learning." The participants in this category also commented on their wariness of being technology-dependent in the classroom. Participant 13 commented on the need for teachers to be comfortable before introducing a new tool into the classroom: "My only goal with technology is to make sure that when I do use it, I know exactly how to use the program."

In the individual interview with P1, she also addressed her desire to use technology more sparingly in her future (second and third) placements:

> I don't think I'm going to rely on computers as much. Like, I think I'm pretty much PowerPoint-ed-out at this point in my education career for this program. I have seen enough PowerPoints, I've had to do enough PowerPoints to last a lifetime […] I'm tired of the projection. Enough, enough with it all! Even Prezi, it

dances too much. Too much dancing. And again, it's too hard for some of the students to follow.

While P1 saw the potential in technology to assist in teaching and learning, she did not view it as the "be-all, end-all" of any lesson.

4.1.5 Participants' overall attitudes and beliefs towards technology in education

Question 5.10 in the questionnaire examined the general attitudes and beliefs of participants towards technology in education. The twenty-four statements within the question were accompanied with a six-point Likert scale (0 = not applicable, 1 = not at all important, 2 = not very important, 3 = neutral, 4 = somewhat important, 5 = extremely important). The results from the data are presented in Table 4a.

Twenty participants (62.5%) thought that it was "extremely important" to integrate technologies other than word processors (e.g., Microsoft Word) or presentation tools (e.g., Microsoft PowerPoint) into teaching and learning. Ten participants (31.3%) identified this as "somewhat important," while one participant (3.1%) identified this as "not very important."

In Table 4a, participants identified the following statements as being either "neutral," "somewhat important," or "extremely important" (3, 4, or 5 on the Likert scale):

- Critically evaluate the technologies that you are required to use in your teaching.
- Critically evaluate the technologies that you are provided with in your school facilities.
- Work alongside students to evaluate how emerging technologies work as learning and teaching tools.

- Provide students with opportunities to create multimodal texts (e.g., digital stories, digital videos, digital book trailers).
- Discuss online searching strategies with students prior to using online sources.

The following statement was the only statement identified by participants as being either "somewhat important" (n = 8) or "extremely important" (n = 24):

- Require students to use and cite online sources when researching a topic.

Statements with the lowest perceived importance frequencies related to blogs and podcasts. Twelve participants (37.5%) believed that reading blogs were not applicable (n = 1), not at all important (n = 3), or not very important (n = 8). Sixteen participants (50%) believed that posting comments on other's blogs were not applicable (n = 1), not at all important (n = 6), or not very important (n = 9). Eighteen participants (56.3%) believed that maintaining their own blogs were not applicable (n = 4), not at all important (n = 7), or not very important (n = 7). Listening to podcasts was viewed by eight participants (25.0%) as being not applicable (n = 1), not at all important (n = 5), or not very important (n = 2).

All other statements were identified as being both important and not important to the participants in varied measures.

Table 4a: Teacher candidates' overall attitudes and beliefs towards technology			
Statement	Response	Frequency	Percent (%)
Integrate technologies other than a word processor or a presentation tool into your teaching.	Not very important	1	3.1%
	Neutral	1	3.1%
	Somewhat important	10	31.3%
	Extremely important	20	62.5%
Provide students with an opportunity to use their own technologies during class time.	Not at all important	1	3.1%
	Not very important	3	9.4%
	Neutral	9	28.1%
	Somewhat important	11	34.4%
	Extremely important	8	25.0%
Critically evaluate the technologies that you are required to use in your teaching.	Neutral	11	34.4%
	Somewhat important	12	37.5%
	Extremely important	9	28.1%
Critically evaluate the technologies that you are provided with in your school facilities.	Neutral	4	12.5%
	Somewhat important	18	56.3%
	Extremely important	10	31.3%
Keep up with the technologies that your students are using outside of the classroom.	Not very important	1	3.1%
	Somewhat important	6	18.8%
	Extremely important	25	78.1%
Work alongside students to evaluate how emerging technologies work as learning and teaching tools.	Neutral	1	3.1%
	Somewhat important	17	53.1%
	Extremely important	14	43.8%
Read blogs.	Not applicable	1	3.1%
	Not at all important	3	9.4%
	Not very important	8	25.0%
	Neutral	11	34.4%
	Somewhat important	5	15.6%
	Extremely important	4	12.5%

Table 4a (continued): Teacher candidates' overall attitudes and beliefs towards technology			
Statement	Response	Frequency	Percent (%)
Post comments on others' blogs.	Not applicable	1	3.1%
	Not at all important	6	18.8%
	Not very important	9	28.1%
	Neutral	9	28.1%
	Somewhat important	3	9.4%
	Extremely important	4	12.5%
Maintain (regularly) your own blog.	Not applicable	4	12.5%
	Not at all important	7	21.9%
	Not very important	7	21.9%
	Neutral	9	28.1%
	Somewhat important	2	6.3%
	Extremely important	3	9.4%
Provide students with opportunities to create multimodal texts (e.g., digital stories, digital videos, digital book trailers).	Neutral	1	3.1%
	Somewhat important	14	43.8%
	Extremely important	17	53.1%
Require students to use and cite online sources when researching a topic.	Somewhat important	8	25.0%
	Extremely important	24	75.0%
Discuss online searching strategies with students prior to using online sources.	Neutral	1	3.1%
	Somewhat important	6	18.8%
	Extremely important	25	78.1%
Listen to podcasts.	Not applicable	1	3.1%
	Not at all important	5	15.6%
	Not very important	2	6.3%
	Neutral	13	40.6%
	Somewhat important	8	25.0%
	Extremely important	3	9.4%

Table 4a (continued): Teacher candidates' overall attitudes and beliefs towards technology

Statement	Response	Frequency	Percent (%)
Provide students with opportunities to create and upload their own original online content.	Not very important	1	3.1%
	Neutral	9	28.1%
	Somewhat important	17	53.1%
	Extremely important	5	15.6%
Provide students with opportunities to interact with authentic audiences online.	Not applicable	1	3.1%
	Not at all important	1	3.1%
	Not very important	1	3.1%
	Neutral	16	50.0%
	Somewhat important	9	28.1%
	Extremely important	4	12.5%
Model responsible practices and uses of technology and the Web for your students.	Not at all important	1	3.1%
	Neutral	1	3.1%
	Somewhat important	8	25.0%
	Extremely important	22	68.8%
Collaborate with other teachers or students to design technology-infused curricula or assignments.	Not at all important	1	3.1%
	Neutral	6	18.8%
	Somewhat important	13	40.6%
	Extremely important	12	37.5%
Learn new strategies and tools for effectively integrating technology into your teaching.	Not at all important	1	3.1%
	Neutral	1	3.1%
	Somewhat important	9	28.1%
	Extremely important	21	65.6%
Belong to a Personal Learning Network (PLN) that focuses on emerging technologies.	Not at all important	3	9.4%
	Neutral	15	46.9%
	Somewhat important	5	15.6%
	Extremely important	9	28.1%

Table 4a (continued): Teacher candidates' overall attitudes and beliefs towards technology			
Statement	Response	Frequency	Percent (%)
Participate in professional development on emerging technologies.	Not at all important	1	3.1%
	Not very important	1	3.1%
	Neutral	3	9.4%
	Somewhat important	8	25.0%
	Extremely important	19	59.4%
Meet with members of your department or division on a regular basis to discuss how emerging technologies can be used.	Not at all important	1	3.1%
	Not very important	1	3.1%
	Neutral	9	28.1%
	Somewhat important	12	37.5%
	Extremely important	9	28.1%
Meet with members of other departments to discuss how emerging technologies can be used.	Not at all important	1	3.1%
	Not very important	1	3.1%
	Neutral	10	31.3%
	Somewhat important	13	40.6%
	Extremely important	7	21.9%
Read current and ongoing research on emerging technologies in schools.	Not at all important	1	3.1%
	Not very important	1	3.1%
	Neutral	8	25.0%
	Somewhat important	12	37.5%
	Extremely important	10	31.3%
Keep up with current policies regarding emerging technologies in your school and school board.	Not at all important	1	3.1%
	Neutral	3	9.4%
	Somewhat important	7	21.9%
	Extremely important	21	65.6%

Tables 4b, 4c, and 4d compare the importance of integrating innovative technologies with the participants' perceived overall technological abilities (Table 4b), gender (Table 4c), and year of birth (4d).

The participants who identified themselves as needing a lot of assistance when using technology thought it was somewhat/extremely important to integrate innovative technologies in the classroom (Table 4b). The only participant who did not think that it was very important to integrate innovative technologies in the classroom needed minimal assistance when using technology; all other participants needing minimal assistance with technology believed it was somewhat important (n = 4) or very important (n = 6) to integrate innovative technologies.

Table 4b: Integrate innovative technologies * Overall technological ability Crosstabulation

		Overall technological ability			Total
		I need a lot of assistance when using technology	I need minimal assistance when using technology	I can use technology without assistance at any time	
Integrate innovative technologies	Not very important	0	1	0	1
	Neutral	0	0	1	1
	Somewhat important	1	4	5	10
	Extremely important	1	6	13	20
Total		**2**	**11**	**19**	**32**

Gender was not a significant factor in determining the importance of integrating innovative technologies into the classroom (Table 4c). The majority of the female and male participants identified themselves as believing it was either somewhat important (Female n = 10) or extremely important (Female n = 14, Male n = 6) to integrate innovative technologies into instructional practices.

Table 4c: Integrate innovative technologies * Gender Crosstabulation

		Gender		Total
		Female	Male	
Integrate innovative technologies	Not very important	0	1	1
	Neutral	1	0	1
	Somewhat important	10	0	10
	Extremely important	14	6	20
Total		**25**	**7**	**32**

The participants' year of birth was also not a significant factor in this area of the study (Table 4d). The participants who selected "Not very important" (n = 1) and "Neutral" (n = 1) were born in 1986 and 1989, which would classify them as digital natives.

Table 4d: Integrate innovative technologies * Year of birth Crosstabulation

Table 4d

*Integrate innovative technologies * Year of birth Crosstabulation*

		Year of birth									Total
		1973	1982	1983	1984	1986	1987	1988	1989	1990	
Integrate innovative technologies	Not very important	0	0	0	0	1	0	0	0	0	1
	Neutral	0	0	0	0	0	0	0	1	0	1
	Somewhat important	0	1	0	0	0	1	1	5	2	10
	Extremely important	1	0	1	1	4	3	4	6	0	20
Total		**1**	**1**	**1**	**1**	**5**	**4**	**5**	**12**	**2**	**32**

4.2 Technology within the Faculty of Education

This section will examine how technology is being used within the participants' teacher education program. The section begins with an examination of time allotted to technology within the broader teacher education program and how the participants reported to have used technology within the faculty. The section then presents participants' feedback on the required technology class and their faculty instructors' uses of technology, as well as their reflections on how technology is/is not being supported in the program.

4.2.1 An examination of time spent on technology in the broader faculty

Teacher candidates were asked about the amount of time that technology was being used within all of their faculty classes in Section 3.1 of the questionnaire. Participants' responses were grouped according to the name that was given to each class. Each class was then given a code for the data analysis, and the findings are represented in Table 5.

It is difficult to compare the results between classes because each class is between one and three hours in length, and participants were not asked about the specific length of each class. It is also difficult to compare the findings between classes because not all classes were required of each participant (for example, the specific subject-area classes). Not all participants answered this question, and not all participants identified each of their classes in their responses. However, it is interesting to examine the range of responses within each individual class.

C1, C2, C8, and C9 received the most responses (n = 15, n = 21, n = 16, n = 13). The standard deviation of responses for C2 (n = 21) was 23.16, and the mean, median, and mode fell within approximately eleven minutes of each other, but the range of

responses was anywhere from 0 to 180 minutes. The large range of responses in C2 is a trend that is mirrored within other classes with high response rates (C1, C8, and C9). This is not meant to be conclusive or a summary of how technology is (or is not) being used in the faculty, and there is no way to confirm or triangulate these particular results. It could be evidence of differentiated teaching from week to week with varied uses of technology by faculty instructors, or it could be the result of how individual participants interpreted the term “emerging technologies” in the original question.

Table 5: Minutes spent using emerging technologies in various teacher education classes

	N		Mean	Median	Mode	Std. Deviation	Variance	Skewness	Std. Error of Skewness	Range
	Valid	Missing								
C1	15	6	66.3333	50.0000	120.00	57.95524	3358.810	.484	.580	180.00
C2	21	0	49.7619	50.0000	60.00	23.15579	536.190	.898	.501	110.00
C3	4	17	32.5000	30.0000	30.00	20.61553	425.000	.713	1.014	50.00
C4	5	16	24.0000	30.0000	30.00	8.94427	80.000	-1.258	.913	20.00
C5	2	19	25.0000	25.0000	10.00[a]	21.21320	450.000			30.00
C6	2	19	.0000	.0000	.00	.00000	.000			.00
C7	7	14	8.5714	.0000	.00	14.63850	214.286	2.122	.794	40.00
C8	16	5	70.6250	60.0000	60.00	58.01939	3366.250	.801	.564	180.00
C9	13	8	30.7692	20.0000	30.00	35.28728	1245.192	1.855	.616	120.00
C10	4	17	30.0000	25.0000	10.00[a]	21.60247	466.667	1.190	1.014	50.00
C11	2	19	60.0000	60.0000	.00[a]	84.85281	7200.000			120.00
C12	9	12	16.6667	.0000	.00	25.49510	650.000	1.351	.717	60.00
C13	6	15	34.1667	17.5000	.00	53.14289	2824.167	2.190	.845	140.00
C14	3	18	18.3333	20.0000	.00[a]	17.55942	308.333	-.423	1.225	35.00
C15	7	14	17.1429	20.0000	20.00	12.53566	157.143	-.682	.794	30.00
C16	6	15	5.0000	.0000	.00	12.24745	150.000	2.449	.845	30.00
C17	6	15	21.6667	25.0000	.00[a]	19.40790	376.667	.146	.845	50.00
C18	6	15	20.0000	15.0000	.00	22.80351	520.000	1.214	.845	60.00
C19	6	15	24.1667	22.5000	30.00	21.07526	444.167	.919	.845	60.00
C20	1	20	80.0000	80.0000	80.00					.00
C21	3	18	33.3333	20.0000	20.00	23.09401	533.333	1.732	1.225	40.00
C22	2	19	20.0000	20.0000	.00[a]	28.28427	800.000			40.00
C23	3	18	16.6667	20.0000	.00[a]	15.27525	233.333	-.935	1.225	30.00
C24	1	20	60.0000	60.0000	60.00					.00
C25	3	18	5.0000	.0000	.00	8.66025	75.000	1.732	1.225	15.00
C26	1	20	60.0000	60.0000	60.00					.00
C27	3	18	40.0000	45.0000	15.00[a]	22.91288	525.000	-.935	1.225	45.00
C28	2	19	120.0000	120.0000	60.00[a]	84.85281	7200.000			120.00
C29	1	20	.0000	.0000	.00					.00
C30	1	20	30.0000	30.0000	30.00					.00

a. Multiple modes exist. The smallest value is shown

4.2.2 Uses and applications of technology by participants in the broader Faculty of Education

Participants were asked about the technologies that they had used within their faculty classes since the beginning of the academic year, and the results are summarized in Table 6a. The most widely used technology tool was a laptop computer, as identified by thirty participants (93.8%). Twenty-eight participants (87.5%) had accessed the Internet in the faculty. Other uses of technology used by 50.0% or more of the participants included email (n = 29), printers (n = 24), cell phones (n = 22), desktop computers (n = 20), MP3 players (n = 16), and scanners (n = 16). CD/DVD burners were only used by two participants (6.3%), which could be attributed to mobile flash drives or cloud storage. The relatively minimal use of electronic books (n = 4) and tablets (n = 4) may be related to device accessibility by participants, but these figures may increase in the future as these tools become more accessible and affordable in the field of education.

Four participants (12.5%) selected “Other” in their responses. Participant 31 mentioned that she used clickers in one of her teacher education classes. No one explicitly mentioned the use of SMART Boards, but SMART Boards were used by teacher candidates for presentations in the required technology class.

Table 6a: Uses of technology by participants in the Faculty of Education			
Variable	Category	Frequency	Percent (%)
Technologies that have been used in class since September:	*CD/DVD Burner*		
	Yes	2	6.3%
	No	30	93.8%
	Cell phone		
	Yes	22	68.8%
	No	10	31.3%
	Laptop computer		
	Yes	30	93.8%
	No	2	6.3%
	Desktop computer		
	Yes	20	62.5%
	No	12	37.5%
	Digital camera		
	Yes	12	37.5%
	No	20	62.5%
	Video camera		
	Yes	7	21.9%
	No	25	78.1%
	Electronic book		
	Yes	4	12.5%
	No	28	87.5%
	Email		
	Yes	29	90.6%
	No	3	9.4%
	Instant messaging		
	Yes	14	43.8%
	No	18	56.3%

Table 6a (continued): Uses of technology by participants in the Faculty of Education			
Variable	Category	Frequency	Percent (%)
Technologies that have been used in class since September: (continued)	*Internet*		
	Yes	28	87.5%
	No	4	12.5%
	MP3 player or iPod		
	Yes	16	50.0%
	No	16	50.0%
	Tablet		
	Yes	4	12.5%
	No	28	87.5%
	Printer		
	Yes	24	75.0%
	No	8	25.0%
	Scanner		
	Yes	16	50.0%
	No	16	50.0%
	Other		
	Yes	4	12.5%
	No	28	87.5%

In addition to being asked *what* technologies they used in the faculty, participants were also asked *how* they were using various technologies. These findings are presented in Table 6b.

Several of the higher frequency technology applications in Table 6b revolve around peer collaboration and the sharing of information. Thirty participants (93.8%) reported using technology to create and share content with their peers. Twenty-nine participants (90.6%) of participants reported that they used technology to participate in online and collaborative projects. The high frequencies of sharing multimedia files (n = 25) and using social networking websites (n = 22) may be closely linked to the collaborative work that is occurring between participants.

Thirty-one participants (96.9%) used technology in the faculty to create presentations, and thirty participants (93.8%) used technology in the faculty to work on assignments. Only one participant (3.1%) had used technology in the faculty to participate in a virtual world, which corresponds to the findings in Table 3e. It is unclear whether this was related to a class in the teacher education program or if this was related to the participant's extracurricular use.

One set of response data in Table 6b conflicted with related response data in Table 6a. All of the participants (100.0%) in Table 6b said that they used the Internet in the faculty, which conflicts with the data in Table 6a, where four participants (12.5%) said that they had not used the Internet.

Table 6b: How computers or emerging technologies have been used by participants in the Faculty of Education			
Variable	Category	Frequency	Percent (%)
Computers or emerging technologies have been used at school to:	*Participate in online/collaborative projects*		
	Yes	29	90.6%
	No	3	9.4%
	Create/share content with my peers		
	Yes	30	93.8%
	No	2	6.3%
	Collaborate on wikis		
	Yes	11	34.4%
	No	21	65.6%
	Create polls or surveys		
	Yes	3	9.4%
	No	29	90.6%
	Blog		
	Yes	5	15.6%
	No	27	84.4%
	Participate in virtual worlds		
	Yes	1	3.1%
	No	31	96.9%
	Build a website		
	Yes	13	40.6%
	No	19	59.4%
	Share multimedia files		
	Yes	25	78.1%
	No	7	21.9%
	Play interactive games		
	Yes	8	25.0%
	No	24	75.0%

Table 6b (continued): How computers or emerging technologies have been used by participants in the Faculty of Education

Variable	Category	Frequency	Percent (%)
Computers or emerging technologies have been used at school to: (continued)	*Use social networking websites*		
	Yes	22	68.8%
	No	10	31.3%
	Participate in chat rooms		
	Yes	11	34.4%
	No	21	65.6%
	Work on assignments		
	Yes	30	93.8%
	No	2	6.3%
	Create presentations		
	Yes	31	96.9%
	No	1	3.1%
	No Internet use at school		
	No	32	100.0%
	Other		
	No	32	100.0%

Table 6c provides an overview of websites used within the faculty classes and a frequency of their mentions within the questionnaires. The frequencies are not necessarily presented as conclusive and quantifiable data, because participants may have forgotten to mention websites that were included in their peers' responses. However, some of the higher frequencies do correspond to findings throughout the rest of the data. CLEW is a platform used by faculty instructors and teacher candidates to exchange information and announcements, and this was mentioned the most (n = 14). YouTube (n = 11) remains one of the most popular tools used by teacher candidates outside of school and in their placements (Table 3f), and the qualitative questionnaire data also suggests that YouTube

was popular with faculty instructors within the teacher preparation program. GoogleDocs (n = 7) support collaborative projects and the sharing of content, as presented in Table 6b. Interview participants P2 and P3 mentioned that they had started Twitter accounts in one of their classes, and Twitter was mentioned by five participants (15.6%).

Table 6c: Websites used within the faculty / frequency of mentions

Website (Frequency)	**Website (Frequency)**
Bitstrips (n = 4)	PhET Interactive Simulations (n = 2)
CLEW (n = 14)	Pinterest (n = 1)
Edu.gov.on.ca (n = 7)	Prezi (n = 4)
Education Canada (n = 1)	Quest Garden (n = 1)
ERCA (n=1)	Rubistar (n = 1)
Facebook (n=6)	Seamonkey (n = 2)
Gizmos (n = 1)	Search engines (n = 1)
Gmail (n = 1)	SIS (n = 2)
Google (n = 6)	STHLE (n = 1)
Google Docs (n = 7)	Teachers.net (n = 1)
Hotmail (n = 3)	Resource/subject area searches (n = 2)
University library (n = 1)	Twitter (n = 5)
Lesson planning websites (n = 2)	UWindsor (n = 2)
Many interactive physics websites (n = 1)	Vanier Institute (n = 1)
Merlot (n = 1)	Webmail (n = 6)
OCT (n = 1)	Webquests (n = 2)
Online curriculum documents (n = 1)	Weebly (n = 2)
Ontario Education Website (n = 1)	Wikipedia (n = 4)
OSSTF (n = 1)	Wordpress(n = 1)
OTFA (n = 1)	Yahoo (n = 3)
PhEd (n = 1)	YouTube (n = 11)

Because the Internet is heavily relied on for many extracurricular and academic uses of technology, participants were asked if they had any particular concerns about the Internet at the university. The findings in Table 6d suggest that there was no overwhelming concern shared by the majority of participants, but smaller clusters of participants certainly did have concerns. School filters (n = 12) and reliability (n = 12) were the two biggest concerns of participants. Ten participants (31.3%) were concerned

with the slow speed of the Internet at the university. Eight participants (25.0%) were concerned with firewalls. Participant 28 complained that the firewalls in the faculty building prevented him from playing games on his personal computer between classes.

Table 6d: Concerns about the Internet at the university

Question	Response	Frequency	Percent (%)
Concerns about Internet at the University	*Slow Speed*		
	Yes	10	31.3%
	No	22	68.8%
	It does not always work		
	Yes	12	37.5%
	No	20	62.5%
	School filters		
	Yes	12	37.5%
	No	20	62.5%
	Firewalls		
	Yes	8	25.0%
	No	24	75.0%
	Other		
	No	32	100.0%

4.2.3 The required technology class

The required technology class in the study was held once a week for fifty minutes, for a total of sixteen weeks spread between field placements. The class had five sections, and the sections were divided into J/I teacher candidates (two sections) and I/S teacher candidates (three sections). The course description for both of the J/I and I/S divisions was as follows:

> This course is designed to explore a range of digital technologies in educational settings. Focusing on teaching, learning and inquiry, students will evaluate digital

> educational resources, critically discuss and assess uses of new media in school-based contexts, gain hands-on experiences with various digital tools, and develop various multimedia instructional tools with the aim of building an intelligent and thoughtful disposition towards the use of multimedia tools within their own classroom and school contexts. (Zhang, 2011 a/b, p. 1)

The syllabus placed heavy emphasis on the importance of hands-on experiences with the technology tools, as well as the importance of developing a critical understanding of the uses of technology in education through discussions and assessments of new media. By the end of the course, students were expected to gain operational competencies, troubleshooting techniques, and an understanding of how technology could be relevant in the pedagogical context and classroom environment.

Teacher candidates were exposed to different technologies in the technology class through instructor-led workshops, required readings, online discussions, and teacher candidate-led "tech workshops". Tech workshops were fifteen to twenty minute presentations on hardware or software applications, held over the course of the academic year and presented individually or in small groups. Teacher candidates presented an application of their choice.

The teacher candidates were halfway through the academic year when they completed the questionnaire and interviews for this study. At this point in the year, twenty-six participants (81.3%) believed that the technology class should be required, five participants (15.6%) believed that the technology class should *not* be required, and one participant (3.1%) selected "Other." These findings are presented in Table 7a.

Participants who thought that the technology class should be required commented that "teachers need to be competent in technology." The digital native vs. digital

immigrant variable was considered by some participants, who viewed the class as "especially important for students who are a little older and not up to the latest technological trends." The class was also seen as valuable to the digital natives, who took certain aspects of technology for granted. On the topic of being able to differentiate between hardware and software, interview participant (and digital native) P2 said, "The instructor in the tech class went over hardware and software, and the difference, and I was so in the dark about all that stuff. And I thought all of that stuff was very useful to know the different between things."

Table 7a: Teacher candidates' thoughts on the required technology class

Variable	Category	Frequency	Percent (%)
The technology class should be required:	Yes	26	81.3%
	No	5	15.6%
	Other	1	3.1%

Table 7b summarizes the hardware, software, and websites used in the required technology class before the questionnaire was completed. This data was collected from self-reported responses provided by participants in questions 4.2, 4.3, and 4.4 of the questionnaire, and does not include technologies explored after the completion of the questionnaires. The technologies were introduced either through instructor-led classes or tech workshops.

Table 7b: Hardware, software, and websites used in the technology class

Hardware	**Software**	**Websites**
Camera	Audacity	Bitstrips
Desktop computers (Mac and Windows platforms)	Bitstrips	Blogging platforms
iPad	DreamWeaver	Facebook
iPod	Excel	Gizmos
Laptop	GarageBand	Google
Lego robotics	Geometers sketch pad	Google Docs
Microphone	iMovie*	Google Panorama
Monitors	iPhoto	Polleverywhere.com
Printer	iWeb	Prezi
Scanner	Keynote	SeaMonkey
SMART Board*	Maple	Skype
Speakers	Microsoft Excel	SMART Exchange
USB memory sticks	Microsoft PowerPoint*	Twitter
Video camera	Microsoft Word	Webmail
	One Note	Webquests
	Pages	Weebly
	Photoshop	Wikipedia
	Photoshop	YouTube
	PowerPoint	
	Prezi	
	SeaMonkey	
	Sketchbook Pro	
	Sketchup	
	Skype	
	SMART Notebook	
	Windows Movie Maker	

**Technology introduced by the instructor and listed in the course syllabus.*

In the questionnaire, participants were asked about technology tools that they were reluctant to integrate, even though they had learned about them in the technology class. SMART Boards remained one of the primary technologies that teacher candidates were most reluctant to integrate into their own classrooms and placements as a result of minimal instructor modeling and hands-on practice, both in their technology class and in the broader faculty. Participant 14 said that while the SMART Board was an excellent resource for teaching and learning, “it terrifies me as I am not particularly strong in the

usage of technology, and technology can be extremely unreliable at times and can "waste" a lot of time in set-up and productivity." This was reiterated in the interview with P1, who said

> I know a couple people would have loved to have three or four classes on the SMART Board and really go in depth into how it works. That is stuff we want to know. Because you throw us in the high school and say, okay, we're going to use the SMART Board, but we got an introductory lesson. I can barely turn the thing on. Some of the boards are different. And then there's portable ones? […] I still don't feel comfortable even turning on a SMART Board.

Several questionnaire participants mentioned that they were not necessarily reluctant to integrate technologies into their classrooms, but they required more time and training to become more comfortable with the tools. Even participants who did not see themselves as "tech savvy" were confident that with practice, their proficiency would increase. Many participants mentioned that they did not feel that the fifty-minute classes provided enough time to learn about and gain hands-on experience with the available technologies. Interview participant P2 said that

> It is good having our Learning with Technologies class, but it's fifty minutes, once a week, and it always compromises different groups presenting. So I have really only had two times to use the SMART Board, and I'm sharing it with six other people in a group.

Also commenting on the group presentations, Interview participant P3 said

> We do a lot of the tech workshops, so if a group presents on how to do a video or whatever, we can kind of follow along on the computers. But I think that it goes

> by too fast, and I feel really rushed. Like, if I went back, I couldn't tell you how to do anything that they said.

Commenting on the time limits for the tech workshops, P4 said, "A lot of people haven't really allotted time for us to do stuff and have stuff set out for us to do."

4.2.4 Faculty instructors and technology

The questionnaire explored the participants' impressions of how faculty instructors (other than their technology instructor) were using technology. These findings are presented in Tables 8a, 8b, 8c, and 8d. When examining the findings, it is important to consider that teacher candidates were providing a general blanketed overview of their perceptions on the entire faculty, versus their perceptions on individual faculty instructors. This may have influenced their responses and the presented data.

Participants were first asked to rank the importance of their faculty instructors using and modeling technology in their faculty classes (Table 8a). Fourteen participants (43.8%) were neutral in their response, thirteen participants (40.6%) selected "very important," and three participants (9.4%) selected "extremely important." Two participants (6.3%) did not view instructor technology integration as important.

In an expanded response to the multiple choice question, Participant 14 discussed the importance of balancing technology with other teaching mediums: "Although I think technology is really important in some classes, it can become relied on too much in place of other mediums and can be unreliable." Participant 20 was neutral about teachers using technology in the classroom, and suggested that there is "still merit to making human connections to students." Also neutral in her response, Participant 30 commented that

> It depends – older instructors who don't use technology as much tend to have the most intriguing and interesting classes. Meanwhile other professors who base

their classes on PowerPoint tend to have the most boring classes – the saying "death by PowerPoint" comes to mind.

It was reiterated through the qualitative sections of the questionnaire that most faculty instructors rely on PowerPoint presentations in their technology delivery.

In response to the importance of faculty instructors using technology in the teacher education classes, Participant 15 thought that this was very important and said that "Teachers should be modeling ways to use the technology." Participant 25 extended this thought and relayed the responsibility of both faculty instructors and teacher candidates to be "up to date with technology."

Table 8a: Teacher candidates' perceptions of faculty instructors & technology: Importance of faculty instructors using technology

Variable	Category	Frequency	Percent (%)
Importance of faculty instructors using technology in the classrooms:	Not important	1	3.1%
	Low importance	1	3.1%
	Neutral	14	43.8%
	Very important	13	40.6%
	Extremely important	3	9.4%

Table 8b presents the findings from teacher candidates' perceptions of their instructors' levels of enthusiasm for technology. Sixteen participants (50.0%) viewed their instructors as "sometimes enthusiastic." Nine participants (28.1%) reported that their instructors were "often enthusiastic," and a total of six participants reported that their instructors were either "rarely enthusiastic" or "not enthusiastic."

Participant 28 commented on the duplicity of the enthusiasm that faculty instructors directed towards technology: "They are enthusiastic about us [teacher candidates] using it in practicum but a lot of them don't use it that well themselves or in a

creative way. They just do PowerPoint presentations or occasional YouTube videos." Several participants also commented that many of the faculty instructors do not know how to troubleshoot when things go wrong with the available technologies.

Table 8b: Teacher candidates' perceptions of faculty instructors & technology: Enthusiasm levels of faculty instructors with technology

Variable	Category	Frequency	Percent (%)
Enthusiasm levels of instructors towards technology:	Not enthusiastic	3	9.4%
	Rarely enthusiastic	3	9.4%
	Sometimes enthusiastic	16	50.0%
	Often enthusiastic	9	28.1%
	Always enthusiastic	1	3.1%

The majority of participants felt that their faculty instructors had adequate access to technology within the faculty (n = 28), as presented in Table 8c. In their qualitative responses, several participants discussed that while they felt the faculty instructors had adequate access to technology, many instructors were making minimal or no use of the available technologies. Only one participant mentioned the need for more projectors and SMART Boards.

Table 8c: Teacher candidates' perceptions of faculty instructors & technology: Instructors' access to technology

Variable	Category	Frequency	Percent (%)
Instructors have adequate access to technology:	Yes	28	87.5%
	No	4	12.5%

While instructor access to technology was viewed as adequate by the majority of participants, only 50% (n = 16) of participants believed that their instructors had adequate technology training, as presented in Table 8d. The participants who did not feel that faculty instructors had enough technology training largely commented on the time it took

faculty instructors to deal with unexpected technology challenges. Many participants expressed frustration with their instructors' inabilities to deal with these challenges, from figuring out how to use the computer and projector, to having to wait for videos to load and buffer on YouTube. Several participants also mentioned that faculty instructors tended to use SMART Boards only as projectors. These teacher candidates sensed that the instructors were not interested in learning more or furthering their own professional development.

In the individual interview with P1, she was asked if she would be able to ask any faculty instructor for assistance with a SMART Board. P1 responded, "I feel like I would probably know more than them, and I don't know a lot at all." P1 proposed that all faculty instructors should be kept up to date on the technologies available to them within the faculty through continual professional development:

> They should all have a technology class! All of them should learn how to troubleshoot. They should learn how to hook up their computer to the consol, and not have to ask the students. And we don't mind and we'll do it, but come on (…) They should all learn the basics. They need a basic class for all of the professors. And the SMART Board as well.

Table 8d: Teacher candidates' perceptions of faculty instructors & technology: Instructors' technology training

Variable	Category	Frequency	Percent (%)
Instructors have adequate technology training:	Yes	16	50.0%
	No	16	50.0%

4.2.5 Teacher candidates' reflections on technology in the Faculty of Education

In question 3.11 of the questionnaire, participants were asked for their opinion of what the Faculty of Education was doing or not doing to enhance teacher candidate learning through technology. The responses were grouped and subsequently categorized into the following data.

Need for more subject-specific and in-depth technology modeling:

Several questionnaire participants noted their desire for more specialized and subject-specific courses in technology. Participant 29 commented that there was not adequate training provided for the effective integration of SMART Boards. In the same vein, Participant 10 felt that

> Training for different technologies such as SMART Boards or certain software programs is not thorough and in depth enough for students to feel confident working with them in a classroom setting. More instruction, practice, and ideas to use technology effectively is [*sic*] needed.

Participant 28 proposed sectioning off technology classes into teachable areas to allow for more subject-specific and relevant technology focuses: "The technology classes need to be sectioned by teachable at least for I/S. I don't want to learn about math software. I will never use it in my music classroom. Math people should explore math software, music should explore music software, etc." While Participant 1 thought that faculty instructors had enough training to use technology in the classroom, she expressed the need for faculty instructors to model more subject-appropriate tools that could be used in placements. This was also mentioned in the interview with P2, who said

> My second teachable is French, and there is a whole separate world of French websites and French resources, and that hasn't been touched on at all. So it's cool

> to know all of these things with Google, but I don't know if any of these other things can be switched over right to French. So that's kind of hard in my content area.

In addition to subject-specific technology classes, several participants also explored the idea of creating sections or classes based on a teacher candidate's existing technological knowledge and comfort (for example, beginner or intermediate). There were also several mentions of the need to explore more teacher-specific software programs, such as MarkBook.

Faculty instructors modeling technology in varying degrees

While many participants agreed that the "use of new technologies should be part of every class," they also felt that "there needs to be more access/encouragement by professors to use technology." Like many of the participants, Participant 24 was grateful for the technology class and faculty resource room. However, she also mentioned that the "instructors in the Faculty of Education need more instruction on how to use technology when they're teaching us. That would be more helpful."

Participants commented that many of their instructors used SMART Boards for "basic slideshows or [for] showing YouTube videos," but that there was little interactive teaching and learning occurring on the interactive white boards. Participant 17 said that "professors do not incorporate interactive presentations in their own classroom lectures" and felt that "we as students are placed at a disadvantage because we lack the experience with emerging technologies." At the time of the questionnaire, Participant 13 remained unconvinced about the potential benefits of technology in teaching and learning: "No one, even the one teacher that thinks new tech is the be-all end-all of the universe, has done

anything to convince me of the necessity of knowing how to use SMART Boards, Prezi, PowerPoint, etc."

A more pessimistic view of instructors' uses of technology came from Participant 15: "They don't use any of it, and set a poor example for teacher candidates. They don't practice what they preach." Participant 3 provided a different portrait of some of the faculty instructors: "Some profs have too much of an emphasis on technology and go overboard. There needs to be a balance between technology in classroom and discussion."

Limited resources

Teacher candidates in the faculty were provided with a computer lab and SMART Boards, but some participants mentioned that "the resource room isn't completely proficient [for] the amount of students who require the facilities." Due to overcrowding, several participants encountered issues in accessing the available resources in the lab. As a result, they said that some "people don't bother going in there to use any of the technology."

The need for more schedule-friendly professional development

Above and beyond the required technology class, Participant 23 suggested that "We should have workshops like the university has for Microsoft Office because the one through the university never has slots available and the times don't work with our schedule." Other workshops suggested by participants included SMART Board technologies and webquests.

The faculty-practicum technology disconnect

Participant 27 was the only individual to explicitly comment on the disconnect between available resources in the faculty versus the practicum: "We are given a lot of opportunities to use it at the Faculty but not to apply it in our practicums."

Positive feedback

While participants had constructive suggestions for the program, they were also complimentary of how the teacher education program was integrating technology. Addressing the different approaches to technology integration between faculties of education, Participant 7 said that "The fact that we have to take a technology class at all is impressive and helpful." Participant 24 agreed that the technology course was helpful, and "also having a resource room for us to have access to a lot of technology is great."

Participant 31 mentioned that the technology course was especially helpful "for those candidates who are not familiar with certain software programs," and for those individuals who would not otherwise be exposed to emerging technologies for teaching and learning. Even participants who identified themselves as needing minimal or no help with technology commented that they had learned about new resources and equipment through specific courses and instructors.

4.3 Technology within the field experience

At the time of this study, all participants had completed one field placement and were preparing to go into their second placement. The findings in this section are the summary of participants' first placements. They were asked to report on the types of technology used in their first placement, how technology was modeled and supported in their placement schools, and any issues they faced when using technology. This section also provides participants' feedback on the relationship between the required technology class and the field experience.

4.3.1 Hardware, software, and websites used by participants in field experiences

Questionnaire participants were asked in Section 5 of the questionnaire to list the hardware, software, and websites they had used during their first practicum. These findings are presented in Figures 5a (hardware), 5b (software), and 5c (websites/Internet).

Hardware (Figure 5a)

In their first placements, teacher candidates integrated the following hardware devices in the highest frequencies: projectors (n = 23), laptops (19), SMART Boards (n = 11), overhead projectors (n = 8), and desktop computers (n = 7). These were devices that had been modeled through the course of their own educations.

Software (Figure 5b)

There were less overall instances of unique software programs compared to hardware devices in the field experiences. Teacher candidates integrated the following software in the highest frequencies: Microsoft PowerPoint (n = 14), Microsoft Word (n = 8), and SMART Notebook (n = 5). The use of PowerPoint and SMART Notebook can be tied to the use of computers and projection units mentioned in the hardware findings. The higher frequency of PowerPoint versus SMART Notebook may also be attributed to the heavy modeling of PowerPoint throughout their own education, especially in the faculty.

Websites (Figure 5c)

Twenty-two participants mentioned that they used YouTube in their first placements. This was the highest frequency of specifically documented Internet use, followed by Google (n = 6) and curriculum documents (n = 4). There were lower mentioned frequences of subject-specific websites.

Participant 28 had commented that the faculty instructors “just do PowerPoint presentations or occasional YouTube videos,” but the placement findings suggest that

teacher candidates are also "just" doing PowerPoint presentations and showing YouTube videos. The participants' pedagogical uses of technology suggest that they may be more influenced by how their faculty instructors and mentor teachers model technology than by their own extracurricular uses of technology. The participants may not use the hardware, software, and websites that they use outside of the classroom because they are unable to make the pedagogical connections to the tools by themselves. PowerPoint and YouTube are two examples of software and websites that have been successfully integrated into teaching and learning, and modeled by the individuals who are teaching the teacher candidates how to be teachers. Teacher candidates also may have used previously modeled technologies because they were concerned with how they would be assessed and evaluated by their faculty instructors and mentor teachers. Using PowerPoint and YouTube may have been an example of the teacher candidates exercising caution in their selection of technology tools for their classrooms.

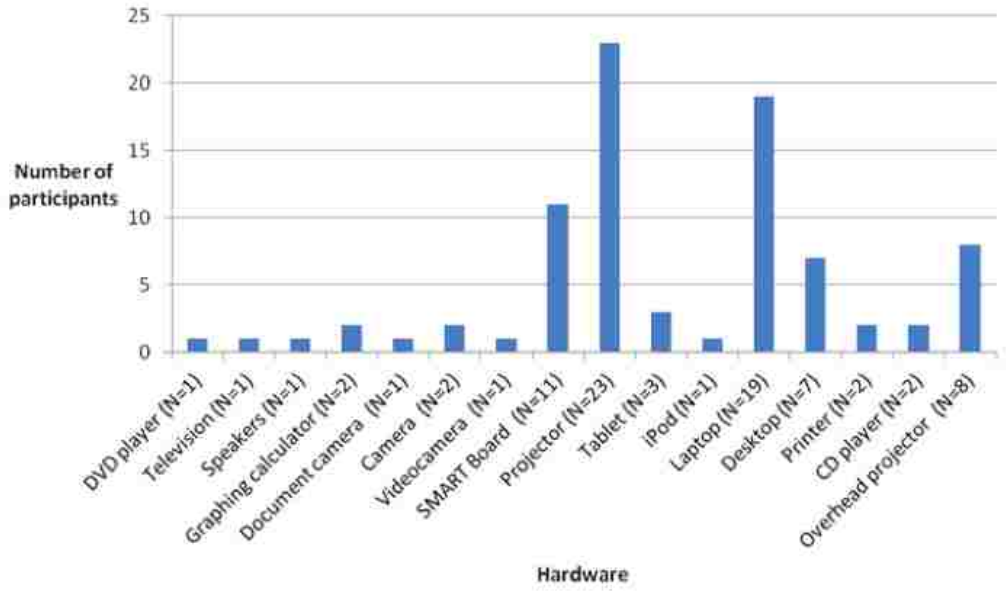

Figure 5a. Hardware integration by participants in their first placement.

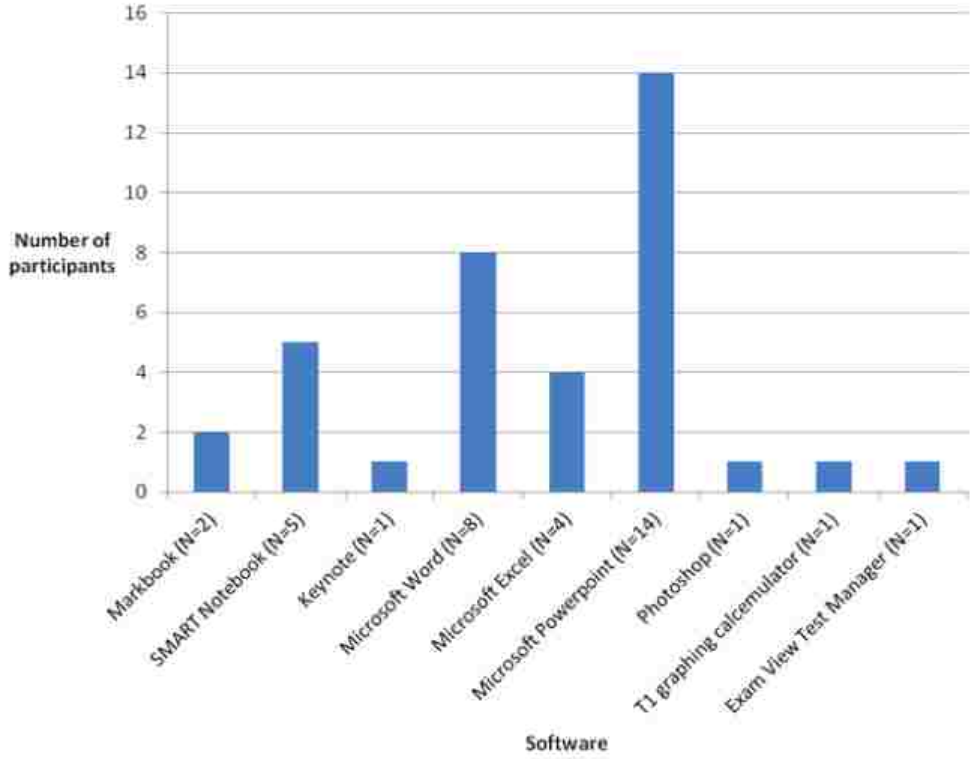

Figure 5b. Software integration by participants in their first placement.

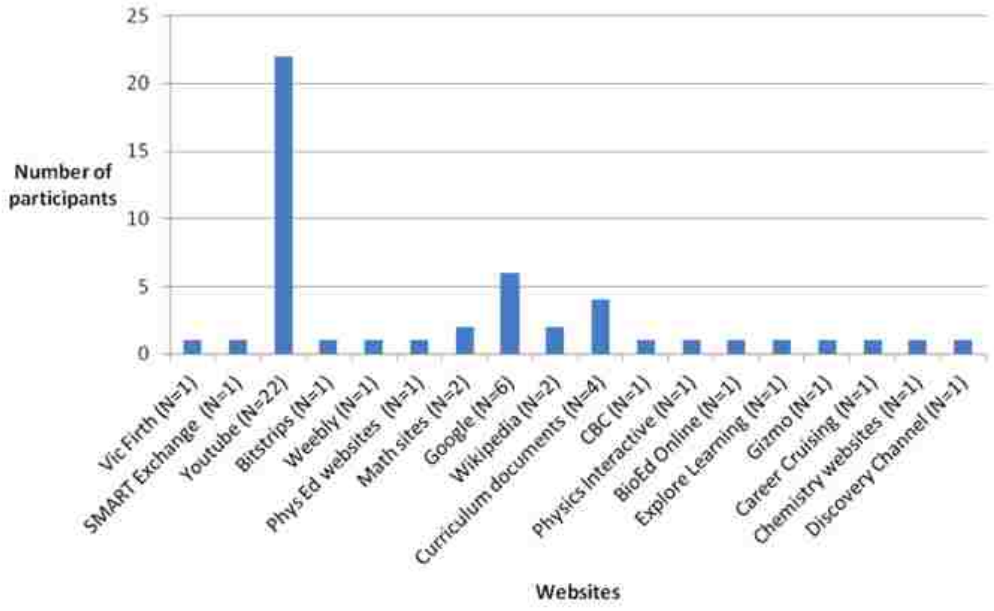

Figure 5c. Internet integration by participants in their first placement.

4.3.2 Comparing the placement experiences of the J/I and I/S divisions

Table 9 provides a less specific overview of the devices used by teacher candidates in their practicum, but provides a percentage comparison of the Junior/Intermediate sample placements (n = 16), the Intermediate/Senior sample placements (n = 16), and the total sample (N = 32).

93.8% of both samples used technology of some sort in their placements. The I/S sample had more access to in-school computer labs (100.0%) and in-classroom computers (75.0%) than the J/I sample. The J/I participants had more access to SMART Boards (62.5%) compared to the I/S participants (43.8%), and 43.8% of J/I participants used the available SMART Boards versus 25.0% of I/S participants. 56.3% of the J/I participants' mentor teachers modeled various uses of technology, compared to 37.5% of I/S participants' mentor teachers. Generally speaking, most elementary schools contain smaller student and teacher populations than high schools, which could possibly equate to increased access to available (shared) devices, such as the SMART Boards, by the J/I division.

When asked if they had been notified of their placement schools' Internet policies, the percentages for both samples were low (J/I = 31.3%, I/S = 25.0%). However, nearly all participants (n = 30) reported having some Internet access in their placements, with 75.0% of J/I participants and 81.3% of I/S participants using the Internet in one or more lesson plans. The J/I participants were more likely to use an alternative presentation tool in their placements, such as Prezi or Keynote. Overall, it was reported that the majority of students and mentor teachers appeared to be comfortable with the technologies that were used by both divisions.

Table 9: Summary of I/S and J/I teacher candidates' reflections on Practicum 1

(percentages)

Statement	Response	Junior/ Intermediate Sample (%)	Intermediate/ Senior Sample (%)	Total Sample (%)
I used technology of some sort in my practicum:	Yes No	93.8 6.3	93.8 6.3	93.8 6.3
There was a computer lab in the school:	Yes No	56.3 43.8	100.0 0.0	78.1 21.9
There was a computer in the classroom:	Yes No	56.3 43.8	75.0 25.0	65.6 34.4
I had access to a SMART Board:	Yes No	62.5 37.5	43.8 56.3	53.1 46.9
I used a SMART Board:	Yes No	43.8 56.3	25.0 75.0	34.4 65.6
My mentor teacher modeled various uses of technology:	Yes No	56.3 43.8	37.5 62.5	46.9 53.1
I was notified of the school's Internet policy:	Yes No	31.3 68.8	25.0 75.0	28.1 71.9
The school had Internet access:	Yes No	93.8 6.3	100.0 0.0	96.9 3.1
The school had wireless Internet access:	Yes No	62.5 37.5	75.0 25.0	68.8 31.3
I used the Internet in a lesson plan during my practicum:	Yes No	75.0 25.0	81.3 18.8	78.1 21.9
I used PowerPoint during my practicum:	Yes No	43.8 56.3	56.3 43.8	50.0 50.0
I used an alternative presentation tool during my practicum:	Yes No	31.3 68.8	6.3 93.8	18.8 81.3

Table 9 (continued): Summary of I/S and J/I teacher candidates' reflections on Practicum 1 (percentages)

Table 9: Summary of I/S and J/I Teacher Candidates' Reflections on Practicum 1 (Percentages)

Statement	Response	Junior/ Intermediate Sample (%)	Intermediate/ Senior Sample (%)	Total Sample (%)
My students were comfortable with the technologies that I used:	Yes No	93.8 6.3	100.0 0.0	96.9 3.1
My mentor teacher was comfortable with the technologies that I used:	Yes No	87.5 12.5	93.8 6.3	90.6 9.4

4.3.3 The modeling of technology by mentor teachers

The data suggest that teacher candidates had varying degrees of access to technology over the course of their first placements. Table 10 summarizes the technologies that were used and modeled for J/I and I/S teacher candidates in their first placements.

Table 10: Technologies modeled by mentor teachers in Practicum 1

Movies	Document camera
YouTube	Online textbooks
Games	Google Images
MacLabs	Graphing calculators
Photoshop	Television
PowerPoint	Desktop computer
Internet	Laptops
SMART Board	Computer lab
Video camera	Classroom computers
Overhead projector	Projector

Several participants reflected on the extensive modeling of technology by their mentor teachers. Participants 18 and 32 were guided by teachers who they considered to be "experts" with SMART Boards and graphing calculators. Participant 14 had the

opportunity to work with online textbooks that were viewed by students on individual laptops. Projectors and overheads were the most popular technology tools used by mentor teachers. These tools were used to convey key terms, ideas, and notes.

Participant 13's questionnaire responses indicated that he remained unconvinced about the potential of teaching and learning technologies in the classroom, and yet he wrote about his mentor teacher's varied uses of technology to accommodate students and promote multimodal student-centred learning:

> My associate took advantage of the school's computer lab for research assignments and cross-curricular activities (math, geography, computers). She also used the computers (2) in the class to adapt lessons for kids with special needs and used the computers when a student had a question that she couldn't answer ("Good question, I'm not sure, go look it up on the computer"). She also used the classroom document camera as a sort of magnifying glass for the students when they presented their science projects.

Participant 13's responses indicate that even with appropriate modeling of technology in the classroom, and additional modeling of the available technologies as *assistive* technologies, not all teacher candidates will necessarily embrace technology in their own teaching and learning. However, Participant 13 was the only participant to explicitly address this.

Participants noted that some mentor teachers did not use or model any type of emerging technologies in their classrooms. Participant 20, who was the oldest teacher candidate in the questionnaire data, said that her mentor teacher "did not use technology at all. She was very traditional." In her physical education class, Participant 3 said that her mentor teacher "did not use technology in the gym," but this may have been an issue of

the physical class environment. Participant 31's mentor teacher used an overhead projector, and "didn't seem to be interested in using the SMART Board or booking rooms with SMART Boards." On the subject of SMART Boards, Interview participant P2 said

> I think it's really important to experience technology in the placement, because our placement prepares us for our future teaching career. What if my first job has a SMART Board and the school is technologically advanced, and I look back at my placement and I had zero experience using it?

Participant 30 commented on the different resources that were available to teachers on a year-to-year (or semester-by-semester) basis: "My mentor used the overhead quite extensively – and I think he would have preferred a SMART Board – he said that the year before he loved having the SMART Board in his classroom but this year he didn't get one." The inequitable distribution of and access to technology was also commented on by P2 and P4 in separate interviews:

> P2: I found out later that the math department actually had SMART Boards that were in the school, but we didn't get to use them. And other classes had iPads for every student that they got to use, so I guess it depended on each class and each department.
>
> P4: As far as I know, there were SMART Boards and a little bit more advanced things like that, only in the department heads' rooms and so we were told that if we needed it or we need to use it, that we could arrange to switch classrooms with the department heads. But at the same time, the answer was going to be no if the department head wanted to use it at that time.

4.3.4 Technical support in placements

Seven participants explicitly stated that they had no available technical support in their placement schools. Responses ranged from "None" and "Nothing" to "Not much." One participant said that "nobody knew how to do anything." Another participant appreciated the help that they received from other teachers "but there was no structured support."

Three participants made mention of a "tech support person," "tech specialist," and "tech support guy." The "tech support person" was at the school once a week during the first participant's placement. The "tech specialist" was gone during the second participant's placement. The third participant did not mention how often the "tech support guy" was available.

Seven participants wrote that they were "not sure" or "unsure" if any technical support was available to them in their placements. Another participant "didn't look into it." One participant was vague about the type of support that "was available after class/school times." The remaining participants who did not provide definitive answers confused *access to technology* with *access to technical support*.

The remaining participants identified other teachers (including an IT teacher, a vice principal, a teacher's husband, and a librarian) as the school's primary technical support individuals, but did not identify a person whose sole job was to offer technical support. These people were viewed as "tech-savvy" individuals who were there to help "if issues arose." One participant noted that "there was one teacher who was a computer expert – and she was the one who taught the students how to set up their edublogs."

4.3.5 Issues with technology in placements

Participants were asked if they had any problems with the available technologies in their placements. Qualitative data was collected in response to this question. Issues that emerged in the data included sharing resources, the physical location of resources, the utilization of personal resources, the (un)reliability of available technology, Internet reliability, and technology dependence. Key points provided by participants are summarized below.

Sharing resources (access)

Sharing a small or finite amount of resources with the entire school population was one of the main technology problems faced by many of the participants. One participant was excited to learn that there was access to iPads in the school, but then discovered that there were only four available iPads. For basic projection purposes, one participant noted that there were "very few LCD projectors." Other instances of minimal resources included one school with a single SMART Board, and another school with one cart of laptops.

Signing out resources proved to be difficult for many of the teacher candidates. Participant 16 lamented that the "Booking out process [was] archaic and [there was] much stealing of [the] cart from other teachers." With limited resources in certain classrooms, the available resources (such as mobile SMART Boards and laptops) were difficult for the teacher candidates to sign out, and there were additional scheduling conflicts that often arose between teachers, classes, and school events.

Resource locations

The location of available resources also proved to be an issue for questionnaire participants. In some instances, SMART Boards were permanently installed in certain

rooms and were not made available to everyone. Participant 28 said that "I wanted to use a SMART Board but it was on the second floor and I was on the first. It pretty much stayed up there." Participant 20 complained that the school's mobile SMART Board "had to be calibrated many times during a lesson."

The utilization of personal resources

The reliability and availability of laptops and projectors in the schools was an issue for many of the participants. Participant 2 said that "the school laptop was ridiculous and didn't work," and ended up using her personal laptop. Participant 26 also brought in her own laptop when she was unable to view her "media" on the school's laptop. Based on the lack of available projectors in another school, Participant 27decided to bring in and utilize his personal projector.

Reliability of available technology

The available technology proved to be unreliable for some of the teacher candidates. Overhead projectors often burnt out and/or broke during instruction, and participants mentioned that this happened more than once. This was difficult for Participant 3, who did not have alternative access to either a SMART Board or an LCD projector. SMART Boards were not immune to issues – participants wrote that the screens occasionally froze, and the projector's bulb sometimes burnt out. Within the math department at one school, Participant 19 was frustrated that the "computer in the math office did not work for the first two weeks."

Internet and web use

Participants had issues with Internet reliability in their placements. While Participant 25 did not see it as a major problem to her teaching, "sometimes the videos

took a while to load." Based on the responses, the main issues to accessing the Internet were frequent disconnections, firewalls that blocked specific websites, and speed.

The issue of student technology dependence

Participant 14 was the only individual who thought that the existence of reliable technology was actually adverse to student learning: "I found in specific study areas students became too dependent on technology instead of "using their imagination" or "research" skills dealing with dictionaries, books, references, etc."

Teacher candidates without issues

Three participants mentioned that they did not have any problems with the available technology in their placements. One participant who had access to a SMART Board throughout their placement felt that "All applied classrooms should have a SMART Board. They are essential to learning."

4.3.6 The relationship between the required technology class and the field experience

Having completed one field experience and half of their own academic year, participants were asked if their placement experiences had been what they expected, based on what they had learned in their technology class. Three main reflective categories emerged: access to resources, the modeling of technology by mentor teachers, and the issues of time and meeting curricular standards.

Access to resources

The amount of available resources was mentioned by most of the participants as a barrier to technology integration in their placements, and this was something that they had not expected based on what they had learned in the technology class. Participant 25 mentioned that "I was expecting to use more technology in my practicum, but I did not

have access to many different technologies," and the majority of participants echoed this sentiment. Reflecting on their first placements, participants mentioned that there was "not enough resources," "a lack of technology," and "little or no Internet usage or computer usage," in both elementary and secondary schools. There were also concerns that the available technology was not "up-to-date" or reliable. With a lack of available technology, there was "not much of a chance to apply and incorporate what I am learning in the class." Participant 30 wrote that she wanted to use Gizmos (online math and science simulations) in her placement, but that she "was not able to use this resource in my practicum because of a lack of technology available in my classroom." However, she did not specify the type of technology that was lacking, or if the technology she needed was available elsewhere.

SMART Boards were the most widely mentioned technology tool in participant responses, and were problematic for many of the participants. These participants commented that the SMART Boards were either non-existent or not widely available in their placement schools, and the SMART Boards were often not fully set-up to be anything more than a projector. Portable SMART Boards (when available) were viewed as "not as reliable and not used very often." Participant 21 also commented on the inequity of available resources within the school: "There was only one SMART Board available and it was mostly for the math department."

Several participants had unexpectedly positive experiences with and access to technology when they were in their placements. The presence of a fully-functioning computer lab, a classroom set of laptops, and ready and reliable access to SMART Boards was a motivating factor to integrate technology for these participants. Participant 19 mentioned that technology was being used "more than I would have expected." With

access to SMART Boards and other technologies, Participant 18 "actually got more than I anticipated based on what I heard."

Modeling of technology by mentor teachers

Several participants mentioned a lack of student-centred technology modeling by their mentor teachers. Participant 17 wrote that "My practicum teacher did not use any technology in her classroom. I did not learn how to use or incorporate technology neither in the practicum or tech class." Participant 7 was also surprised by her mentor teacher's dislike of the classroom's SMART Board, and found that "He'd rather project things right on the wall because it was bigger and everyone could see it." While technology was being used as an assistive device to increase classroom accessibility, the participant seemed to be concerned that the SMART Board was not being used for student-centred learning. Participant 10 observed that "Laptops are used as "pacifiers" during free time rather than as learning tools." Several participants mentioned that they knew mentor teachers would not be using many of the technologies that the teacher candidates were learning about in the technology class, and they did not enter their placements with the expectation that they would have models for or access to technology.

The issue of time and curricular standards

Time was mentioned by several participants as a challenge. Even with available resources, Participant 2 mentioned that "there is not enough time to help twenty-five kids with their computers." Participant 14 found it difficult to balance the curricular expectations with the implementation of technology: "I feel like there is too much of a time crunch and expectation in relaying and teaching information and experimenting with technology that students at most get ripped out of proper instruction and advantages in

usage." While interview participant P4 expressed a desire to use the SMART Board in her first placement, she commented on the time constraints between and within classes:

> There were only three minutes between classes. So if one teacher was using the portable SMART Board in period one and I wanted to use it in period two, to get it set up and into my classroom would take ten minutes. And with a thirty-eight minute class, I've already lost a big chunk of my class time.

Two questionnaire participants mentioned that they did not have any expectations for the practicum based on what they had learned in their technology class, but one hoped that they would have better access to SMART Boards in their second placement.

CHAPTER V

DISCUSSION AND CONCLUSION

This mixed methods study used quantitative and qualitative questionnaires and qualitative individual interviews to examine the situational, institutional, and dispositional variables that affect whether or not teacher candidates will use technology in their placements, as well as the relationship between the required technology class, the faculty of education, and the teacher candidates' first placements. The study took place in a consecutive Ontario Faculty of Education that had a stand-alone learning technologies course that was required of all teacher candidates (P/J, J/I, and I/S).

This chapter will provide a summary of how the research questions were answered through a review of the major findings, the limitations of the current study, suggestions for future research, and recommendations for practice.

5.1 Review of the major findings and the research questions

This section will answer the following research questions by providing an overview of the results as they pertain to the teacher candidates, the required technology class, the broader faculty of education, and the field placements:

1. What is the relationship between the preservice curriculum and classroom realities met by the teacher candidates in their practicum experiences?
2. How does a teacher candidate's experience(s) with technology in the preservice program affect their experience(s) with technology in their practicum(s)?
3. What situational, institutional, and/or dispositional variables influence a teacher candidate to use or not use technology in their practicum(s)?

5.1.1 The teacher candidates

The study consisted of thirty-two teacher candidates (N = 25 females and 7 males) who participated in questionnaires, and four teacher candidates (N = 4 females) who participated in individual or two-person interviews. The majority of the participants were considered 'digital natives' – individuals who have been surrounded by technology, at home or in society, for most or all of their lives. There were a variety of experiences and efficacy levels within this particular group of teacher candidates, and the 16 J/I participants and 16 I/S participants came from a variety of academic backgrounds and teachable areas.

59.4% of the participants (n = 19) reported that they could use technology without any assistance at any time, while 34.4% of the participants (n = 11) reported that they needed minimal assistance when using technology. Similar to the study conducted by Sang et al. (2010), there was a slight correlation of gender to one's perceived technological competence but the data cannot be generalized to the studied sample or all teacher candidates due to the small number of male participants (n = 7) compared to female participants (n = 25). Age was not a determining factor in one's overall perceived technological ability – the two participants who needed a lot of assistance when using technology were both born in 1989, and therefore qualified as digital natives. The differences mentioned in the literature between digital natives and the digital immigrants could not be supported by the quantitative and qualitative data in this study, primarily because of the lack of digital immigrants.

The participants were primarily female and primarily of the digital native generation, which may have affected the results. Participants of a younger age may have been more comfortable participating in the survey because of their previous exposure to

technology, but it would have been valuable to receive feedback from the "digital immigrant" teacher candidates, as well as more male participants.

The tables in Section 1.3 of the data analysis provide a summary of the participants' self-reported extracurricular uses of technology, and it is clear that all of the participants were 'connected' through some form of technology in their everyday lives. Most notably, 100% of the participants (N = 32) had access to the Internet, laptop computers, and cell phones at home, and all of the participants spent some time on the Internet everyday. Nearly all participants (n = 30) were using their devices to create and share content and multimedia with peers, as well as to collaborate with other people online.

Social networking websites were used by 93.8% of the participants (n = 30) at home, but the numbers dropped drastically when asked about the social networking tools that they had used in their placements. Teacher candidates seemed torn about the use of social networking websites as pedagogical tools, and many digital native participants seemed to support the idea of creating and enforcing "walled gardens" to protect students from 'inappropriate' content (Hartley, 2009, p. 130). YouTube was the only social networking website to be used by more than half of the participants, both at home and in their placements. Despite teacher candidates' heavy use of Facebook at home and the introduction of Twitter in a faculty class, these websites were each used by only 3.1% (n = 1) of the teacher candidates in their placements.

Qualitative data gathered from the participants' questionnaires identified several goals for teacher candidates using or wanting to use technology in the classroom. First, the participants saw technology as a way to engage the students in interactive and relevant learning that connected their outside worlds to their classroom. Second, participants

viewed technology as a means to promote differentiated and multimodal learning that could bring otherwise one-dimensional ideas to life. The science participants in this study reiterated points vocalized by participants in Donnelly et al.'s (2011) study, that technology "has a very, very useful place in science teaching because some of the concepts can be explained so easily with the right animation" (p. 1473). Third, many of the participants were motivated to learn and integrate new pedagogical tools as they moved into their final placements and careers, which reflects the pedagogical potential they see in technology.

Several of the participants mentioned that they would not bring technology into the classroom without critical consideration, which aligns with the ISTE Essential Condition of Assessment and Evaluation, wherein there is a "Continuous assessment of teaching, learning, and leadership, and evaluation of the use of ICT and digital resources" (ISTE, 2009). These participants saw the value in using technology for teaching and learning, but were also aware that the tools existed to *complement* (and not replace) their instructional practices. They wanted a thorough understanding and working knowledge of the tools, and appropriate technical and administrative support from within their school communities, which also align with ISTE's Essential Conditions.

The findings for participants' overall attitudes and beliefs towards technology suggest that this particular sample had enthusiasm for technologies other than word processors and presentation software, and the majority of participants saw value in bringing student-centred technologies into their classrooms. However, these participants will require supportive school environments and technical support to maintain these views. It is one thing for a teacher candidate participant to self-report that they want to learn new strategies and tools, collaborate with other teachers, and work alongside

students; it is another thing entirely when they become inservice teachers with varying levels of school support, professional development, and time.

In this sample, the teacher candidates who self-identified as possessing lower technology efficacies and technological abilities still saw value in bringing innovative technologies into the classroom. For many participants, their conflicting questionnaire responses suggested that their overall technological abilities were actually much lower than reported – for example, many participants were still wary of integrating the SMART Board into their instructional practices, even though they had reported that they could use technology without assistance at any time. Nonetheless, the enthusiastic dispositions of these participants suggest that they have the potential to develop and hone their skills with proper faculty and placement support.

5.1.2 The required technology class

While 81.3% of the participants believed that the technology class should be mandatory, they had reservations about the time allotted to hands-on experiences and the length of the class in general (fifty minutes, once a week). It is evident that they were exposed to a wealth of new technologies (Table 7b), but the overarching concern was that they were exposed to *too much content* with *too little time* to get comfortable. The tech workshops were beneficial because they introduced teacher candidates to a variety of pedagogical tools, but the qualitative data suggests that teacher candidates were not being given sufficient time to interact with the new tools that were introduced on a weekly basis. As Sutton (2011) discussed, the retention and transfer of technology tools to the classroom will only occur if teacher candidates are given time and hands-on experiences.

Considering that very few of their faculty instructors and mentor teachers were integrating innovative and student-centred technologies into their own practices, the

individual tech workshops appeared to be the only times that teacher candidates were exposed to new forms of educational hardware, software, and websites. While participants were grateful to be exposed to technology tools that they had not known about before, their retention levels were affected by the pace of the individual classes and the overall course, similar to participants in Sutton's (2011) study. The SMART Board was only introduced on one occasion, and many participants suggested that more time be spent on getting acquainted with the SMART Board and its associated software.

It was unclear as to how the teacher candidates were instructing their peers during the tech workshops – was it constructivist? Were specific subject areas being addressed? Were teacher candidates given ample time to work with the tools after the presentations, or did the classes shift to different and unrelated content? It was also unclear if the technology course provided teacher candidates with opportunities for critical reflection on the relationship between the required technology class and their placements. There was no mention in the quantitative or qualitative data of participants being given feedback on their ongoing uses of technology in the technology class, but it is clear that they were provided with some degree of technological knowledge (TK).

5.1.3 The faculty of education

General access to resources within the faculty was not an issue, as was reiterated throughout the results. It is evident that participants were using technology in individual and collaborative ways within the broader faculty of education, but it remains unclear as to the amount of time technology was being modeled in classes other than the required technology class.

Participants reported that it was important for faculty instructors to explicitly model subject-specific technologies. While the majority of participants viewed their

faculty instructors as having some level of enthusiasm for technology, participants also reported that their instructors were not necessarily trained to use and/or troubleshoot the technologies available within the faculty of education. Perhaps as a result of this, SMART Boards were primarily used as projectors for PowerPoint (versus SMART Notebook) and YouTube videos, which also translated into how the teacher candidate participants tended to use technology in their own placements. This study suggests that teacher candidates may subconsciously emanate the instructional methods of their own teachers and mentors. When choosing whether or not to integrate technology, teacher candidates will consciously and subconsciously refer to their past experiences "from the earliest grades to college" (Lambert & Gong, 2004, p. 67).

In the questionnaire, participants were asked to provide feedback on the faculty of education's efforts to enhance teacher candidate learning through technology. Broadly categorized, participants provided the following feedback:

1. Participants identified a need for more subject-specific and in-depth technology training, above and beyond the required technology class. Similar to participants in Lei's (2009) study, the teacher candidates did not have a lot of experience with subject-specific technologies. If teachers are going to see the value in any type of technology, "the technology must be supported from a pedagogical perspective" (Campbell & Martin, 2010, p. 72). Reflecting on the faculty's approaches to technology, content, and pedagogy, it was evident that participants were being provided with technological knowledge (TK) in their technology course and content knowledge (CK) and pedagogical knowledge (PK) in their methods courses, but not necessarily TPACK. Teacher candidates need to see the explicit interaction of TK, CK, and PK if they are going to effectively integrate

technology into their own content areas and classrooms (Mishra & Koehler, 2006).

2. Participants reported that faculty instructors were modeling technology, and more specifically, SMART Boards, in varying degrees. As noted by Campbell and Martin (2010), "Simply having a large electronic workspace does not necessarily open a lesson to higher student interaction" (p. 69). New technology tools being used in old ways was a trend identified throughout the study.
3. Participants identified the need for teacher candidates to have an increased access to resource rooms to enhance their understanding and hands-on opportunities with technology tools outside of designated class time.
4. Participants requested an increase in schedule-friendly professional development pertaining to technology, focusing on specific hardware and software skills and how they could be incorporated into their subject areas.
5. Participants commented on the technological disconnect and differing expectations between the faculty and the placements.
6. Participants appreciated the existence of the required technology course. Some teacher preparation programs are still developing technology courses or only offer technology as an elective (or not at all).

5.1.4 The placements

Based on the collected data, it is evident that the majority of the study's participants in the required technology course had expectations about the various technologies that they would be exposed to within their placements. However, in their reflections on their first placements, participants felt that "Schools are not embracing the

full potential of technology" based on what they had learned so far in the technology class.

Access to technology was ultimately context- and school-dependent for the participants in this study. However, *access* and *personal experience/efficacy* did not always translate into *use*, which differs from the reviewed literature. There were instances of teacher candidates having access to SMART Boards, but the school's layout, scheduling, and technical support (or lack thereof) made it nearly impossible to actually integrate the available technologies into lesson plans. The argument could be made that the teacher candidates may have sought out the less accessible tools (such as mobile SMART Boards located on other floors) in their placements if they had higher efficacy levels and prior training, but this is speculative. In other instances, teacher candidates brought in their own devices when they ran into problems with school-wide resource sharing or resource reliability, which raises the issue of whether teachers or teacher candidates should even be expected to use their own devices in the first place.

What is troubling is that very few of the teacher candidates were notified about their placement school's Internet policies, which often align with overall school and board technology policies. Whether or not teacher candidates sought out the policy is beside the point – to introduce various technologies acquired in the required technology course, participants need to understand the contexts of their schools. Teacher candidates should never have to assume whether something is or is not allowed, and this responsibility falls into the hands of the administration. It is clear that the Internet was used by the majority of the participants within one or more lesson plans, but very few of these participants were made explicitly aware of the freedom or restrictions that they had available to them in their placements.

Similar to faculty instructors, mentor teachers modeled technology in individual and context-dependent ways. It is interesting to note that the only participant (Participant 13) who talked about their mentor teacher using technology in truly innovative and accessible ways was *still* not convinced about technology's relevance in education. Table 10 provides an overview of various technology tools that were modeled by the collective group of the participants' mentor teachers. Based on the data, the majority of mentor teachers appeared to support the participants' uses of technology in the placement classrooms.

Overall, teacher candidates had varied and sometimes-ambiguous access to technical support, which ranged from an identifiable but rarely available individual to another educator or administrator within the school. If all of the teacher candidates had access to consistent and reliable technical support to implement technology within their placements, the quantitative data may have reflected an increase in technology use. However, funding is problematic and affects the types of available support – if schools are to introduce and maintain a technology infrastructure, skilled personnel, digital resources, and opportunities for staff development, consistent and adequate funding needs to be made available.

5.2 Limitations of the study

In this study, the timeframe was the most significant limitation. I only had several weeks to distribute the questionnaires and conduct interviews before the teacher candidates began their second placement. During the times between placements when the teacher candidates attend faculty classes, the curriculum is intensive and their schedules are demanding. Perhaps because the questionnaires and interviews were voluntary, the sample sizes of the questionnaire (N = 32) and the interviews (N = 4) were relatively

small. Had I been able to distribute questionnaires for teacher candidates to complete during class time, I would likely have expected a 100 per cent response rate (Basit, 2010). The response rate may also have been affected by the amount of open-ended questions involved, "mainly because people prefer talking to writing" (Basit, 2010, p. 84). In the case of questionnaires that must be returned by the participants at a later date, "it is not unusual for researchers to receive only 20 to 30 percent of the questionnaires" (Nardi, 2006, p. 68).

Because the study was conducted with a small sample of J/I and I/S participants within the context of one technology class in one particular faculty, the results in this study cannot be generalized to the entire teacher candidate population or other teacher preparation programs in Ontario and around the world. Only five sections of one class were included in this study, and not every teacher candidate participated. Each classroom and school presents a varied set of contexts, people, dispositions, and access to resources. If time had permitted, the study would have benefitted from additional J/I and I/S perspectives, P/J (Primary/Junior) perspectives, faculty instructor perspectives, and mentor teacher perspectives. To have a better grasp on the relationship(s) between age, gender, and the integration of instructional and pedagogical technologies, the study would also have benefitted from additional digital immigrant and male perspectives.

Another primary limitation is that the study was based on self-reported data. There may be inconsistencies between what the participants reported and what actually occurred in the technology classes and/or the participants' placements. Participants were also given the option of leaving questions unanswered on the questionnaires, which led to gaps in certain portions of the questionnaire. Future studies would benefit from an observational component to further triangulate the data that is compiled from the questionnaires and

interviews.

At the time this study was conducted, the teacher candidates had only experienced one of their three required placements. If this study were longitudinal in nature, it would be beneficial to follow up on the initial set of questionnaires and interviews after the completion of all placements. A longitudinal study could also follow the teacher candidates into their first several years of teaching to observe the short-term and long-term effects of a required technology course on technology in the classroom. More research is needed with an increased number of participants and time for observation.

5.3 Suggestions for future research:

Subsequent research is needed in this area of study as educational environments and available technologies continue to evolve. The following recommendations are derived from the findings and limitations of this study:

1. While time-consuming, interviews provided the most in-depth examination of the variables that affected whether or not teacher candidates integrated technology into their placements. Additional teacher candidate interviews and follow-up interviews at the end of each placement would help to substantiate the questionnaire data.
2. Observations within the required technology class and the participants' placements would offer a way to corroborate the self-reported data, and provide a better perspective of the variables that encourage or inhibit faculty instructors and mentor teachers from using/modeling instructional technologies. It would also allow the researcher to determine if technology is being used in traditional or constructivist ways, and how the context/subject area of the class affects whether or not technology is integrated.

3. Perceptions were limited to five sections of a required technology class for J/I and I/S teacher candidates. It would be beneficial to get feedback from additional J/I and I/S teacher candidates, P/J teacher candidates, faculty instructors, mentor teachers, and administrators in the Faculty of Education as well as the placements. Recommendations can be offered based on the collected data, but the data is ultimately self-reported and biased.
4. A longitudinal mixed method study could be conducted throughout the entire teacher preparation program to compare the variables in multiple placements and to follow teacher candidates into their careers. Opportunities for observation would also be beneficial to this type of study.
5. The question pertaining to ethnic origin in the questionnaire should not be open-ended. Participants provided answers that were difficult to code and categorize, and this was one of the primary reasons that these data were not included in the findings.
6. This study could be conducted within individual teacher preparation programs to assess how technology is being integrated across the broader faculties, in addition to how faculty-learned technology skills are being applied in or transferred to the placements.

5.4 Recommendations for practice

Culled from the reviewed literature, data analysis, and teacher candidate recommendations, the following are recommendations for practice within teacher preparation programs and placement schools:

1. In their study on inservice and preservice teachers' technology integration, Greenhow et al. (2008) mentioned that "Districts may spend all the money they

would like on the newest technologies, but if the teachers don't know how to use it, more and newer technology won't help" (p. 19). If schools and faculties of education are going to invest in expensive innovative technologies (such as SMART Boards), they need to invest in the professional development of the parties who will be using (or who will be expected to use) these technologies. Otherwise, the interactive technologies will continue to be used in one-dimensional ways – or not at all. Technology changes quickly, and teacher preparation programs need to be dynamic in their approach to pedagogical technology instruction. If teacher preparation programs are going to support the technological education of teacher candidates, technology needs to be infused throughout entire programs, and modeled by every instructor. Ongoing professional development and workshops for faculty instructors and teacher candidates should be a top priority, above and beyond the required technology class.

2. If faculties are going to continue to push for the technological education of teacher candidates, the emphasis should not only be from the bottom up (the teacher candidates) but from the top down (the administration, faculty instructors, and mentor teachers). In this study, teacher candidates were receptive to the idea of using technology in their own classrooms, but the majority of participants did not have adequate modeling from faculty instructors and mentor teachers who appeared to lack sufficient technology and troubleshooting training with the available technologies.
3. More troubleshooting strategies are needed for teacher candidates, faculty instructors, and mentor teachers. If teacher candidates have the opportunity to

observe and deal with technical challenges in hands-on ways in their year of teacher education, they may be less intimidated and more inclined to integrate technology in fearless and innovative ways in their careers.

4. If teacher preparation programs have a vision of integrating educational technologies into the curriculum, faculties should increase their efforts to provide teacher candidates with opportunities to be placed with mentor teachers who model subject-specific and constructivist technologies. Teacher preparation programs should ensure that all candidates are exposed to "authentic" experiences with technology (Gronseth et al., 2010; Chai & Lim, 2011) in at least one of their placements.
5. Teacher preparation programs should continue to develop and offer technology courses, which expose teacher candidates to new tools and instructional practices. Teacher candidates may benefit from smaller class sizes, subject-specific technology demonstrations, and experience-specific classes (such as beginner or advanced).
6. Teacher preparation programs and placement schools cannot assume that digital natives – or, by extension, any students – know how to use technology for the purposes of teaching and learning. Institutions need to focus on synthesizing the areas of technological knowledge (TK), content knowledge (CK), and pedagogical knowledge (PK) that would otherwise develop independently of one another during the teacher preparation program.

REFERENCES

Abner, G.H., & Lahm, E.A. (2002). Implementation of assistive technology with students who are visually impaired: Teachers' readiness. *Journal of Visual Impairment & Blindness, 96*(2), 98-105.

Adcock, L., & Bolick, C. (2011). Web 2.0 tools and the evolving pedagogy of teacher education. *Contemporary Issues in Technology and Teacher Education, 11*(2), 223-236.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Basit, T. (2010). *Conducting research in educational contexts.* New York, New York: Continuum International Publishing Group.

Beers, K., Probst, R.E., & Rief, L. (2007). Appendix B: What counts in teaching English with technology? In Beers, K., Probst, R.E., & Rief, L. (Eds.), *Adolescent literacy: Turning promise into practice* (p. 381). Portsmouth, New Hampshire: Heinemann.

Bell, S.M., Cihak, D.F., & Judge, S. (2010). A preliminary study: Do alternative certification route programs develop the necessary skills and knowledge in assistive technology? *International Journal of Special Education, 25*(3), 110-118.

Berk, R.A. (2009). "Teaching strategies for the Net Generation." *Transformative Dialogues: Teaching & Learning Journal, 3*(2), 1-24.

Bowman, S., & Willis, C. (2003). *We Media: How audiences are shaping the future of news and information.* Retrieved September 27, 2010, from http://www.hypergene.net/wemedia/

Brannen, J. (1995). Combining qualitative and quantitative approaches: an overview. In J. Brannen (Ed.), *Mixing methods: Qualitative and quantitative research* (pp. 1-37). Aldershot, England: Avebury Ashgate Publishing.

Browne, J. (2009). Assessing pre-service teacher attitudes and skills with the technology integration confidence scale. *Computers in the Schools, 26*(1), 4-20.

Buechler, S. (2010). Using Web 2.0 to collaborate. *Business Communication Quarterly, 73*(4), 439-443.

Campbell, C., & Martin, D. (2010). Interactive whiteboards and the first year experience: Integrating IWBs into pre-service teacher education. *Australian Journal of Teacher Education, 35*(6), 68-75.

Chai, C.S., & Lim, C.P. (2011). The Internet and teacher education: Traversing between the digitized world and schools. *Internet and Higher Education, 14*(1), 3-9.

Chai, C.S., Koh, J.H.L., & Tsai, C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). *Educational Technology & Society, 13*(4), 63-73.

Chau, C. (2010). YouTube as a participatory culture. *New Directions for Youth Development,* (128), 65-74.

Chen, R. (2010). Investigating models for preservice teachers' use of technology to support student-centered learning. *Computers & Education, 55*(1), 32-42.

Chmiliar, L., & Cheung, B. (2007). Assistive technology training for teachers: Innovation and accessibility online. *Developmental Disabilities Bulletin, 35*(1), 18-28.

Creswell, J. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd ed.). Upper Saddle River, New Jersey: Pearson Education.

Davis, F. D. (1989). Perceived usefulness, perceived ease-of-use, and user acceptance of information technology. *MIS Quarterly, 13*, 319–340.

Davis, N.E., & Loveless, A. (2011). Reviewing the landscape of ICT and teacher education over 20 years and looking forward to the future. *Technology, Pedagogy and Education, 20*(3), 247-261.

DeGennaro, D. (2010). Grounded in theory: Immersing preservice teachers in technology-mediated learning. *Contemporary Issues in Technology and Teacher Education, 10*(3), 338-359.

Donnelly, D., McGarr, O., & O'Reilly, J. (2011). A framework for teachers' integration of ICT into their classroom practice. *Computers & Education, 57*(2), 1469-1483.

Duncan, H.E., & Barnett, J. (2009). Learning to teach online: What works for pre-service teachers. *Journal of Educational Computing Research, 40*(3), 357-376.

Dyal, A., Carpenter, L.B., & Wright, J.V. (2009). Assistive technology: What every school leader should know. *Education, 129*(3), 556-560.

Edutopia Staff. (2008). *Why integrate technology into the curriculum? The reasons are many.* Retrieved December 20, 2011, from http://www.edutopia.org/technology-integration-introduction

Foehr, G., Rideout, V.J., Ulla, M.A., & Roberts, D.F. (2010). *Generation M2: Media in the lives of 8- to 18-year-olds.* Retrieved on December 16, 2011, from http://www.kff.org/entmedia/upload/8010.pdf

Gao, P., Chee, T.S., Wang, L., Wong, A., & Choy, D. (2011). Self-reflection and preservice teachers' technological pedagogical knowledge: Promoting earlier adoption of student-centred pedagogies. *Australasian Journal of Educational Technology, 27*(6), 997-1013.

Gao, P., Choy, D., Wong, A., & Wu, J. (2009). Developing a better understanding of technology based pedagogy. *Australasian Journal of Educational Technology, 25*(5), 714-730.

Gao, P., Wong, A. F. L., Choy, D., & Wu, J. (2010). Developing leadership potential for technology integration: Perspectives of three beginning teachers. *Australasian Journal of Educational Technology, 26*(5), 643-658.

Gorlewski, J. (2008). "Christ and cleavage: Multiculturalism and censorship in a working-class, suburban high school." *English Journal, 97*(3), 26-30.

Greenhow, C., Robelia, B., & Hughes, J.E. (2009). "Web 2.0 and classroom research: What path should we take now?" *Educational Researcher, 38*(4), 246-259.

Gronseth, S., Brush, T., Ottenbreit-Leftwich, A., Strycker, J., Abaci, S., Easterling, W., Roman, T., Shin, S., & van Leusen, P. (2010). Equipping the next generation of teachers: Technology preparation and practice. *Journal of Digital Learning in Teacher Education, 27*(1), 30-36.

Guo, R., Dobson, T., & Petrina, S. (2008). Digital natives, digital immigrants: An analysis of age and ICT competency in teacher education. *Journal of Educational Computing Research, 38*(3), 235-254.

Hammond, M., Crosson, S., Fragkouli, E., Ingram, J., Johnston-Wilder, P., Johnston-Wilder, S., Kingston, Y., Pope, M., & Wray, D. (2009a). Why do some student teachers make very good use of ICT? An exploratory case study. *Technology, Pedagogy and Education, 18*(1), 59-73.

Hammond, M., Fragkouli, E., Suandi, I., Crosson, S., Ingram, J., Johnston-Wilder, P., Johnston-Wilder, S., Kingston, Y., Pope, M., & Wray, D. (2009b). What happens

as student teachers who made very good use of ICT during pre-service training enter their first year of teaching? *Teacher Development, 13*(2), 93-106.

Hammond, M., Reynolds, L., & Ingram, J. (2011). How and why do student teachers use ICT? *Journal of Computer Assisted Learning, 27*(3), 191-203.

Handsfield, L.J., Dean, T.R., & Cielocha, K.M. (2009). Becoming critical consumers and producers of text: Teaching literacy with Web 1.0 and Web 2.0. *The Reading Teacher, 63*(1), 40-50.

Hartley, J. (2009). Users of YouTube: Digital literacy and the growth of knowledge. In Burgess, J., & Green, J. (Eds.), *YouTube: Digital Media and Society Series* (pp. 129-135). Cambridge, England: Polity Press.

Hixon, E., & So, H. (2009). Technology's role in field experiences for preservice teacher training. *Educational Technology & Society, 12*(4), 294-304.

Israel, M., Knowlton, E., Griswold, D., & Rowland, A. (2009). Applications of video-conferencing technology in special education teacher preparation. *Journal of Special Education Technology, 24*(1), 15-25.

ISTE. (2009). *Essential conditions*. Retrieved on December 15, 2011, from http://www.iste.org/Libraries/PDFs/NETSEssentialConditions.sflb.ashx

ISTE. (2011a). *Digital age learning*. Retrieved on December 15, 2011, from http://www.iste.org/standards/nets-for-students.aspx

ISTE. (2011b). Digital age teaching. Retrieved on December 15, 2011, from http://www.iste.org/standards/nets-for-teachers.aspx

Kaminski, J. (2009). "Forward: New media and scholarship." *Transformative Dialogues: Teaching & Learning Journal, 3*(2), 1-2.

Laarhoven, T.R.V., Munk, D.D., Lynch, K., Bosma, J., & Rouse, J. (2007). A model for preparing special and general education preservice teachers for inclusive education. *Journal of Teacher Education, 58*(5), 440-455.

Lambert, J., & Gong, Y. (2010). 21st century paradigms for pre-service teacher technology preparation. *Computers in the Schools, 27*(1), 54-70.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87-97.

Lemke, C., Coughlin, E., Garcia, L., Reifsneider, D., & Baas, J. (2009). *Leadership for Web 2.0 in education: Promise and reality.* Retrieved November 30, 2011, from http://www.cosn.org/LeadershipforWeb20inEducationReport/tabid/5359/Default.aspx

Manning, J.B., & Carpenter, L.B. (2008). Assistive technology WebQuest: Improving learning for preservice teachers. *TechTrends, 52*(6), 47-52.

Marino, M. T., Sameshima, P., & Beecher, C. C. (2009). Enhancing TPACK with assistive technology: Promoting inclusive practices in preservice teacher education. *Contemporary Issues in Technology and Teacher Education, 9*(2), 186-207.

Messinger-Willman, J., & Marino, M.T. (2010). Universal Design for Learning and assistive technology: Leadership considerations for promoting inclusive education in today's secondary schools. *NASSP Bulletin, 94*(1), 5-16.

Mishra, P., & Koehler, M. (2006). Technological Pedagogical Content Knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054.

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education, 51*(4), 1523-1537.

Nardi, P.M. (2006). *Doing survey research: A guide to quantitative methods* (2nd ed.). Boston, Massachusetts: Pearson Education.

Ontario College of Teachers. (2011a). Professional Advisory: Use of Electronic Communication and Social Media. Retrieved on July 6, 2011, from http://www.oct.ca/publications/PDF/Prof_Adv_Soc_Media_EN.pdf

Ontario College of Teachers. (2011b). *Teacher education programs.* Retrieved on January 2, 2012, from http://www.oct.ca/become_a_teacher/faculties.aspx

Pamuk, S., & Thompson, A.D. (2009). Development of a technology mentor survey instrument: Understanding student mentors' benefits. *Computers & Education, 53*(1), 14-23.

Prensky, M. (2001). Digital natives, digital immigrants. Retrieved November 1, 2011 from http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf

Project Tomorrow. (March 2010). *Creating our future: Students speak up about their vision for 21st century Learning – 2009 National Findings.* Retrieved December 1, 2011, from http://www.tomorrow.org/speakup/pdfs/SUNationalFindings2009.pdf

Ross, K. (2010). *Gendered media: Women, men, and identity politics*. Lanham, Maryland: Rowman & Littlefield Publishers, Inc.

Safhi, M.Y., Zhou, L., Smith, D.W., & Kelley, P. (2009). Assistive technology in teacher-training programs: A national and international perspective. *Journal of Visual Impairment & Blindness, 103*(9), 562-568.

Sahin, I. (2011). Development of survey of technological pedagogical and content knowledge (TPACK). *Turkish Online Journal of Educational Technology, 10*(1), 97-105.

Sang, G., Valcke, M., van Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education, 54*(1), 103–112.

Schneiter, K. (2010). Preparing teachers to use technology: Considerations from a capstone mathematics and technology course. *Contemporary Issues in Technology and Teacher Education, 10*(4), 457-469.

Shoffner, M. (2009). "Because I know how to use it": Integrating technology into preservice English teacher reflective practice. *Contemporary Issues in Technology and Teacher Education, 9*(4), 371-391.

Smith, D.W., & Kelley, P. (2007). A survey of assistive technology and teacher preparation programs for individuals with visual impairments. *Journal of Visual Impairment & Blindness, 101*(7), 429-433.

Smith, D.W., Kelley, P., Maushak, N.J., Griffin-Shirley, N., & Lan, W.Y. (2009). Assistive technology competencies for teachers with students with visual impairments. *Journal of Visual Impairment and Blindness, 103*(8), 457-469.

Spalter-Roth, R. (2000). Gender issues in the use of integrated approaches. In M. Bamberger (Ed.), *Integrating quantitative and qualitative research in development projects* (pp. 47-53). Washington, DC: The World Bank.

Starkey, L. (2010). Supporting the digitally able beginning teacher. *Teaching and Teacher Education: An International Journal of Research and Studies, 26*(7), 1429-1438.

Steinweg, S.B., Williams, S.C., & Stapleton, J.N. (2010). Faculty use of tablet PCs in teacher education and K-12 settings. *TechTrends: Linking Research and Practice to Improve Learning, 54*(3), 54-61.

Sutton, S.R. (2011). The preservice technology training experiences of novice teachers. *Journal of Digital Learning in Teacher Education, 28*(1), 39-47.

Swabey, K., Castleton, G., & Penney, D. (2010). Meeting the standards? Exploring preparedness for teaching. *Australian Journal of Teacher Education, 35*(8), 29-46.

Tashakkori, A., & Teddlie, C. (1998). Mixed methodology: Combining qualitative and quantitative approaches. Thousand Oaks, California: Sage Publications.

Teo, T. (2009a). Examining the relationship between student teachers' self-efficacy beliefs and their intended uses of technology for teaching: A structural equation modelling approach. *Turkish Online Journal of Educational Technology. 8*(4), 7-15.

Teo, T. (2009b). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education, 52*(2), 302-312.

Teo, T., Lee, C.B., Chai, C.S., & Choy, D. (2009). Modelling pre-service teachers' perceived usefulness of an ICT-based student-centred learning (SCL) curriculum: A Singapore study. *Asia Pacific Education Review, 10*(4), 535-545.

Thieman, G. Y. (2008). Using technology as a tool for learning and developing 21st century citizenship skills: An examination of the NETS and technology use by preservice teachers with their K-12 students. *Contemporary Issues in Technology and Teacher Education, 8*(4), 342-366.

UOIT. (2012b). *Laptop education*. Retrieved April 1, 2012, from http://www.education.uoit.ca/future_students/consecutive_education/laptop-education.php

UOIT. (2012a). *Technology-enriched learning*. Retrieved April 1, 2012, from http://www.uoit.ca/current_students/academic_resources/technology-enriched-learning.php

Vockley, M. (2008). *Maximizing the impact: The pivotal role of technology in a 21st century education system*. Retrieved December 27, 2011, from http://www.setda.org/web/guest/maximizingimpactreport

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wheeler, S., & Wheeler, D. (2009). Using wikis to promote quality learning in teacher training. *Learning, Media and Technology, 34*(1), 1-10.

Zhang, Z. (2011a). *80-322 Course Outline.* (Available from the University of Windsor Faculty of Education, 401 Sunset Avenue, Windsor, ON N9B 3P4)

Zhang, Z. (2011b). *80-332 Course Outline.* (Available from the University of Windsor Faculty of Education, 401 Sunset Avenue, Windsor, ON N9B 3P4)

APPENDIX A: A summary of technology in consecutive teacher education programs in Ontario

School	Required Course (P/J)	Required course (J/I)	Required course (I/S)	Elective course (P/J)	Elective course (J/I)	Elective course (I/S)	Tech PD/training offered	Laptop program
Brock	✓	✓	✗	✗	✗	✓	✓	✗
Lakehead	✗	✗	✗	✓	✓	✓	?	✗
Laurier	✓	✓	N/A	✓	✓	N/A	✓	✓
Nipissing	✓	✓	✓	✓	✓	✓	?	✓
Queen's	✗	N/A	✗	✓	N/A	✓	✓	✗
Trent	✗	N/A	✗	?	N/A	?	?	✗
UOIT	✓	N/A	✓	✓	N/A	✓	✓	✓
Ottawa	✗	✗	✗	✓	✓	✓	✓	✗
OISE	✗	✗	✗	✗	✗	✗	?	✗
Western	✗	✗	✗	✓	✓	✓	?	✗
Windsor	✓	✓	✓	✗	✗	✗	✓	✗
York	✗	✗	✗	✗	✗	✗	✓	✗

***Laurentian is not included because the Laurentian teacher education program only offers Concurrent programs.

✓ Offered
✗ Not offered
? This was not made clear online or there was no response to the request for information

APPENDIX B: Letter of permission to the Dean of the Faculty of Education

Dr. Martha Lee
Faculty of Education, University of Windsor
401 Sunset Avenue
Windsor, ON

December 14, 2011

Dear Dr. Lee,

I am writing to you to ask for your approval to conduct a research study in the Faculty of Education. The study, entitled "Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities," will be used as the foundation for my final graduate thesis project in the Faculty of Education.

The study will investigate the situational, institutional, and dispositional variables that can affect the relationship between the preservice curriculum in the Learning with Technology class and the classroom realities that are met by the teacher candidates in their practicum experiences. The students in the five classes will be invited to voluntarily participate in a questionnaire and/or focus group(s), with the option of individual interviews for those students who do not feel comfortable responding in front of their peers. Confidentiality will be ensured and respected during all processes involved in this study.

Permission for this study has been approved by the Research Ethics Board from the University of Windsor. A copy of the REB-approved consent document is attached to this letter.

I have also attached the procedures for the study and the study instruments, which include the questionnaire questions and the focus group interview questions.

If you have any questions or concerns about the study or the instruments that will be used, please contact me at (519) 300-0309 or by email (morris1b@uwindsor.ca). You can also contact my advisor, Dr. Zuochen Zhang at (519) 253-3000 ext. 3960 or by email (zuochen@uwindsor.ca).

Thank you for considering my request to complete this research study within the Faculty of Education.

Sincerely,

Noelle Morris	Zuochen Zhang
Principal Investigator	*Supervisor*

APPENDIX C: Letter of information

LETTER OF INFORMATION FOR CONSENT TO PARTICIPATE IN RESEARCH (Teacher Candidate Participants)

Title of Study:
Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

You are asked to participate in a research study conducted by **Noelle Morris**, from the Faculty of Education at the University of Windsor. The results that are obtained from this study will contribute to a Master's Thesis.

If you have any questions or concerns about the research, please feel to contact Dr. Zuochen Zhang from the Faculty of Education at the University of Windsor. Dr. Zhang can be reached at (519) 253-3000 x 3960. Ms. Morris can be reached by email at morris1b@uwindsor.ca.

PURPOSE OF THE STUDY

Through a questionnaire and focus groups, the study is intended to study the situational, institutional, and dispositional variables that can affect the relationship between the preservice Learning with Technology curriculum and the classroom realities that are met by the teacher candidates in their practicum experiences. The study will also investigate whether the training and/or equipment needs of the teacher candidates are being met both in the University classroom and their practicum environments, at both the elementary and secondary levels.

PROCEDURES

If you volunteer to participate in this study, you will be asked to do one or both of the following:
1. Participate in a questionnaire that will take place outside of class time. This survey will ask questions about your situational, institutional, and dispositional attitudes towards technology in your Faculty of Education experience and your practicum experience(s). This questionnaire will be collected several minutes before your Learning with Technology class begins on (insert date here, pending REB approval).
2. Participate in a focus group interview that will take place outside of class time. If teacher candidates are uncomfortable in a group setting or are less inclined to disclose information in front of fellow teacher candidates, they will have the option of meeting with Ms. Morris individually.

Data collection for questionnaires and focus groups will end on January 31, 2012.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks, discomforts, or inconveniences associated with the questionnaire.

Focus groups are group events and have increased social risks.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

The research is expected to provide the following benefits:

- Teacher candidates will have the opportunity to compare and contrast their own experiences with the experiences of their peers; this can be helpful in building ongoing professional relationships and fostering potential professional learning communities or networks
- The demonstration of how teacher candidates' university experiences are brought into the classroom (or not)
- The identification of potential challenges in the shift from the Learning with Technologies class to the elementary or secondary classroom practicum, and identifying the potential cause of these challenges

- Assisting teacher candidates in considering, developing, and furthering their own pedagogy and technological practices
- Providing information and considerations (based on the collected data) for future research endeavours

COMPENSATION FOR PARTICIPATION

All teacher candidates who participate in the questionnaire and/or focus group interviews will be eligible to win one of two $50 gift certificates to the Keg in downtown Windsor. A random drawing will take place at the end of the data collection. Please complete the ballot at the bottom of the Consent Form.

CONFIDENTIALITY

Focus groups are group events and have increased risks. Focus group methodology carries with it implications for confidentiality.

Participants will be provided with pseudonyms in the collected and coded data.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be involved in the questionnaire, focus groups, and/or individual interviews involved in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer in the questionnaire, focus groups, or individual interviews and still remain in the study.

Any withdrawal from the questionnaire must be done before the questionnaire is submitted to Ms. Morris. The questionnaires will be considered anonymous once they have been submitted, as they do not contain any identifiers or names.

Focus group participants can choose to leave the room before, during, or after the discussion. One cannot withdraw data from a focus group.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS

The findings of this study will be made available to the teacher candidate participants on or before April 30, 2012. The findings from this study will be posted on the Faculty of Education's website (www.uwindsor.ca/education). If applicable, the findings will also be posted on the REB website (http://www.uwindsor.ca/reb/). Teacher candidate participants will be informed of the study results by Ms. Morris and Dr. Zhang.

Date when results are available: April 30, 2012

SUBSEQUENT USE OF DATA

Data may be used in subsequent studies and/or research.

RIGHTS OF RESEARCH SUBJECTS

If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

_____ _____

Signature of Investigator Date

APPENDIX D: Consent form

CONSENT TO PARTICIPATE IN RESEARCH
(Teacher Candidate Participants)

Title of Study:
Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

You are asked to participate in a research study conducted by **Noelle Morris**, from the Faculty of Education at the University of Windsor. The results that are obtained from this study will contribute to a Master's Thesis.

If you have any questions or concerns about the research, please feel to contact Dr. Zuochen Zhang from the Faculty of Education at the University of Windsor. Dr. Zhang can be reached at (519) 253-3000 x 3960. Ms. Morris can be reached by email at morris1b@uwindsor.ca.

PURPOSE OF THE STUDY

Through a questionnaire and focus groups, the study is intended to study the situational, institutional, and dispositional variables that can affect the relationship between the preservice Learning with Technology curriculum and the classroom realities that are met by the teacher candidates in their practicum experiences. The study will also investigate whether the training and/or equipment needs of the teacher candidates are being met both in the University classroom and their practicum environments, at both the elementary and secondary levels.

PROCEDURES

If you volunteer to participate in this study, you will be asked to do one or both of the following:
1. Participate in a questionnaire that will take place outside of class time. This survey will ask questions about your situational, institutional, and dispositional attitudes towards technology in your Faculty of Education experience and your practicum experience(s). This questionnaire will be collected several minutes before your Learning with Technology class begins on (insert date here, pending REB approval).
2. Participate in a focus group interview that will take place outside of class time. If teacher candidates are uncomfortable in a group setting or are less inclined to disclose information in front of fellow teacher candidates, they will have the option of meeting with Ms. Morris individually.

Data collection for questionnaires and focus groups will end on January 31, 2012.

POTENTIAL RISKS AND DISCOMFORTS

There are no foreseeable risks, discomforts, or inconveniences associated with the questionnaire.

Focus groups are group events and have increased social risks.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

The research is expected to provide the following benefits:

- Teacher candidates will have the opportunity to compare and contrast their own experiences with the experiences of their peers; this can be helpful in building ongoing professional relationships and fostering potential professional learning communities or networks
- The demonstration of how teacher candidates' university experiences are brought into the classroom (or not)

- The identification of potential challenges in the shift from the Learning with Technologies class to the elementary or secondary classroom practicum, and identifying the potential cause of these challenges
- Assisting teacher candidates in considering, developing, and furthering their own pedagogy and technological practices
- Providing information and considerations (based on the collected data) for future research endeavours

COMPENSATION FOR PARTICIPATION

All teacher candidates who participate in the questionnaire and/or focus group interviews will be eligible to win one of two $50 gift certificates to the Keg in downtown Windsor. A random drawing will take place at the end of the data collection. Please complete the ballot at the bottom of the Consent Form.

CONFIDENTIALITY

Focus groups are group events and have increased risks. Focus group methodology carries with it implications for confidentiality.

Participants will be provided with pseudonyms in the collected and coded data.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be involved in the questionnaire, focus groups, and/or individual interviews involved in this study. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you do not want to answer in the questionnaire, focus groups, or individual interviews and still remain in the study.

Any withdrawal from the questionnaire must be done before the questionnaire is submitted to Ms. Morris. The questionnaires will be considered anonymous once they have been submitted, as they do not contain any identifiers or names.

Focus group participants can choose to leave the room before, during, or after the discussion. One cannot withdraw data from a focus group.

FEEDBACK OF THE RESULTS OF THIS STUDY TO THE SUBJECTS

The findings of this study will be made available to the teacher candidate participants on or before April 30, 2012. The findings from this study will be posted on the Faculty of Education's website (www.uwindsor.ca/education). If applicable, the findings will also be posted on the REB website (http://www.uwindsor.ca/reb/). Teacher candidate participants will be informed of the study results by Ms. Morris and Dr. Zhang.

Date when results are available: April 30, 2012

SUBSEQUENT USE OF DATA

Data may be used in subsequent studies and/or research.

RIGHTS OF RESEARCH SUBJECTS

If you have questions regarding your rights as a research subject, contact: Research Ethics Coordinator, University of Windsor, Windsor, Ontario N9B 3P4; Telephone: 519-253-3000, ext. 3948; e-mail: ethics@uwindsor.ca

SIGNATURE OF RESEARCH SUBJECT/LEGAL REPRESENTATIVE

I understand the information provided for the study [Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities] as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

_____
Name of Subject

_____ _____
Signature of Subject Date

SIGNATURE OF INVESTIGATOR

These are the terms under which I will conduct research.

_____ _____
Signature of Investigator Date

Cut here

Thank you for participating in the study, "Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities."

By filling out this ballot, you will eligible to win one of two $50 gift certificates to the Keg in downtown Windsor. A random drawing will take place at the end of the data collection on (insert date here). You will be notified by phone or email.

Name:

_____

APPENDIX E: Questionnaire

January 10, 2012

Title:
Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

Dear Teacher Candidate Participant,

Thank you for your willingness to answer this survey, which focuses on your experiences with and opinions on emerging technologies, in your Bachelor of Education and in your practicum(s). The information that you provide will be used as data in a graduate thesis project. Through a questionnaire and focus groups, the study is intended to study the situational, institutional, and dispositional variables that can affect the relationship between the preservice curriculum in technology and the classroom realities that are met by the teacher candidates in their practicum experiences. The study will also investigate whether the technology training and/or equipment needs of the teacher candidates are being met both in the University classroom and their practicum environments, at both the elementary and secondary levels.

For the purposes of this survey, emerging technologies refer to hardware and software devices, communication devices, social media, and Internet/Web 2.0 tools used at home and in the classroom.

Your responses will be compared with your peers' responses, in addition to the other Learning with Technology classes. Your answers are confidential, and you will not be able to be identified based on your responses.

You will have two weeks to complete the survey. Please return the survey to Ms. Morris on January 24, 2012 in your regular classroom.

All teacher candidates who participate in the questionnaire and/or focus group interviews will be eligible to win one of two $50 gift certificates to the Keg in downtown Windsor. A random drawing will take place at the end of the data collection.

Your time, participation, and input are greatly appreciated. If you need additional space, please write on the back of the questionnaire.

If you are interested in participating in the focus group interviews or have any questions or concerns about the project, please contact Noelle Morris (morris1b@uwindsor.ca) or Zuochen Zhang (zuochen@uwindsor.ca).

Sincerely,

Noelle Morris

Section 1: Your Information

1.1 / Sex:

- ❑ Female
- ❑ Male

1.2 / Ethnic origin: _____

1.3 / Year of birth: _____

1.4 / Learning with Technology (80-332) section:

- ❑ 1
- ❑ 2
- ❑ 3
- ❑ 4
- ❑ 5

1.5 / Current division:

- ❑ Primary/Junior
- ❑ Junior/Intermediate
- ❑ Intermediate/Senior

1.6 / Please identify your teachable areas: _____

_____

_____

1.7 / Please identify your undergraduate degree(s): _____

_____

_____

1.8 / ***If applicable***, please identify your Master's degree(s): _____

_____

_____

1.9 / Rate your overall ability using technology.

- ❑ I can use technology without assistance whenever I need to.
- ❑ I need minimal assistance when using technology.
- ❑ I need a lot of assistance when using technology.
- ❑ I cannot use technology without assistance.

Notes: _____

_____

Section 2: At Home

2.1 / What electronic and communication devices do you have access to at home? Check all that apply.

- ❑ Cell phone (without Internet access)
- ❑ Smart Phone
- ❑ Desktop
- ❑ Laptop
- ❑ MP3 player
- ❑ Tablet device (such as the iPad)
- ❑ Other: *(please list)*

Notes: _____

_____

_____

2.2 / How many computers are in your household?

- ❑ None
- ❑ 1
- ❑ 2
- ❑ 3
- ❑ Other:

2.3 / Does your home computer have access to the Internet?

- ❑ Yes
- ❑ No
- ❑ I don't have a computer at home

2.4 / Do you have a smartphone?

- ❑ Yes
- ❑ No

2.5 / You use your cell phone to: *(Check all that apply)*

- ❑ Make phone calls
- ❑ Send and receive text messages
- ❑ Send and receive emails
- ❑ Send and receive instant messages
- ❑ Access the internet
- ❑ Access social networking sites
- ❑ Play games
- ❑ Play, listen and view multimedia (images, video, music)
- ❑ Post multimedia (images, video, music)
- ❑ I don't have a cell phone
- ❑ Other (please list)

Notes: _____

_____

2.6 / This year at home, you have used computers or cell phones to: *(Check all that apply)*

- ❑ Participate in online and collaborative projects
- ❑ Create and share content with my peers
- ❑ Collaborate on Wikis
- ❑ Create polls or surveys
- ❑ Blog
- ❑ Participate in virtual worlds (such as Second Life)
- ❑ Build a website
- ❑ Share media files (photos, videos, music)
- ❑ Play interactive games
- ❑ Use social networking websites
- ❑ Participate in chat rooms
- ❑ Work on assignments
- ❑ Create presentations
- ❑ I have not used the Internet at home
- ❑ Other:

Notes: _____

_____

_____

2. 7 / Outside of school, how much time per day do you spend on the Internet? _____

2.8 / Based on your response in 2.7, how much time is dedicated to schoolwork or practicum preparation? _____

2.9 / Do you use social networking websites at all?

- ❑ Yes
- ❑ No
- ❑ I don't know what social networking websites are

2.10 / If you selected yes in the previous question, please check all the social networking websites that you regularly use, as well as whether or not you have posted content to any of the websites and whether you have had the chance to use these websites in your practicum(s).

	I use this website regularly:	I have posted content on this website:	I have used this website in my practicum(s):
Facebook	☐	☐ Yes ☐ No	☐ Yes ☐ No
Twitter	☐	☐ Yes ☐ No	☐ Yes ☐ No
YouTube	☐	☐ Yes ☐ No	☐ Yes ☐ No
MySpace	☐	☐ Yes ☐ No	☐ Yes ☐ No
LinkedIn	☐	☐ Yes ☐ No	☐ Yes ☐ No
Blogs	☐	☐ Yes ☐ No	☐ Yes ☐ No
Other:	☐	☐ Yes ☐ No	☐ Yes ☐ No
Other:	☐	☐ Yes ☐ No	☐ Yes ☐ No
Other:	☐	☐ Yes ☐ No	☐ Yes ☐ No

Notes: _____

_____

Section 3: In the Faculty of Education

3.1 / On average, list the amount of time per week you spend using emerging technologies in each of your current classes in the Faculty of Education. List your class names followed by the amount of time spent with emerging technologies per week (example: Learning with Technology, 60 minutes).

- Class 1: _____ Time Spent: _____ minutes
- Class 2: _____ Time Spent: _____ minutes
- Class 3: _____ Time Spent: _____ minutes
- Class 4: _____ Time Spent: _____ minutes
- Class 5: _____ Time Spent: _____ minutes
- Class 6: _____ Time Spent: _____ minutes
- Class 7: _____ Time Spent: _____ minutes
- Class 8: _____ Time Spent: _____ minutes

Notes: _____

_____

_____

3.2 / Check all of the technologies that you have used in your classes since September: *(Check all that apply)*

- ❑ DVD/CD burner
- ❑ Cell phone
- ❑ Laptop
- ❑ Desktop computer
- ❑ Digital camera
- ❑ Video camera
- ❑ Electronic book
- ❑ Email
- ❑ Instant messaging
- ❑ Internet
- ❑ MP3 player or iPod
- ❑ Tablet
- ❑ Printer
- ❑ Scanner
- ❑ Wireless Internet
- ❑ Other: _____

Notes: _____

_____

_____

3.3 / This year at school, you have used computers and emerging technologies to: *(Check all that apply)*

- ❑ Participate in online and collaborative projects
- ❑ Create and share content with my peers
- ❑ Collaborate on Wikis
- ❑ Create polls or surveys
- ❑ Blog
- ❑ Participate in virtual worlds (such as Second Life)
- ❑ Build a website
- ❑ Share media files (photos, videos, music)
- ❑ Play interactive games
- ❑ Use social networking websites
- ❑ Participate in chat rooms
- ❑ Work on assignments
- ❑ Create presentations
- ❑ I have not used the Internet in school
- ❑ Other: _____

Notes:

3.4 / In the space below, list all of the websites that you have used in your classes since September:

Notes:

3.5 / What are some of your concerns about the Internet at the University? Select all that apply.

- ❑ Slow speed
- ❑ It does not always work
- ❑ School filters
- ❑ Firewalls
- ❑ Other:

Notes:

3.6 / How important is it that your instructors use technology in the classroom?

- ❑ Not important
- ❑ Low importance
- ❑ Neutral
- ❑ Very important
- ❑ Extremely important

Notes:

3.7 / In general, how enthusiastic are your instructors about technology?

- ❑ Not enthusiastic
- ❑ Rarely enthusiastic
- ❑ Sometimes enthusiastic
- ❑ Often enthusiastic
- ❑ Always enthusiastic

Notes:

3.8 / As a teacher candidate, what are some of your own goals for using technology in the classroom?

Notes:

3.9 / In general, do you feel that the Faculty of Education instructors have access to adequate equipment to use technology in the classroom?

- ❑ Yes
- ❑ No

Notes:

3.10 / In general, do you feel that your Faculty of Education instructors have enough training to use technology in the classroom?

- ❑ Yes
- ❑ No

Notes:

3.11 / In your opinion, what is the Faculty of Education doing or not doing to enhance teacher candidate learning through technology? Explain.

Notes:

Section 4: Learning with Technology

4.1 / Do you believe that the Learning with Technology class should be a mandatory class?

- Yes
- No
- Other: _____

Notes:

4.2 / In the space provided, please list any **hardware** you have used in Learning with Technology:

4.3 / In the space provided, please list any **software** you have used in Learning with Technology:

4.4 / In the space provided, please list any **websites** you have used in Learning with Technology:

4.5 / After being in the Learning with Technology class, what technologies are you **comfortable** integrating into your own classrooms or practicums?

4.6 / After being in the Learning with Technology class, what technologies are you **reluctant** to integrate into your own classrooms or practicums?

Section 5: Practicum Experiences

5.1 / Identify the number of practicums that you have completed this year:

- ❑ 1
- ❑ 2
- ❑ 3
- ❑ Other: _____

5.2 / Please list any **hardware** you have used during your practicum's (for example, the SmartBoard):

Practicum 1	Practicum 2	Practicum 3

5.3 / Please list any **software** you have used during your practicums (for example, SmartNotebook):

Practicum 1	Practicum 2	Practicum 3

5.4 / Please list any websites you have used during your practicums:

Practicum 1	Practicum 2	Practicum 3

5.5 / Reflect on your practicums. Please check yes or no in the boxes below.

	Practicum 1	Practicum 2	Practicum 3
I used technology of some sort in my practicum:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
There was a computer lab in the school:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
There was a computer in the classroom:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I had access to a SmartBoard:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I used a SmartBoard:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
My mentor teacher modeled various uses of technology:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I was notified of the school's Internet policy:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
The school had Internet access:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
The school had wireless Internet access:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I used the Internet in a lesson plan during my practicum:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I used PowerPoint during my practicum:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
I used an alternative presentation tool during my practicum (please list): _____	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
My students were comfortable with the technologies that I used:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
My mentor teacher was comfortable with the technologies that I used:	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

5.6 / How have your mentor teachers in your practicums used technology? Please explain.

5.7 / When in your practicum(s), what kind of tech support was offered by the school for technology?

5.8 / Did you have any problems with the available technology in your practicum(s)? Please explain.

5.9 / Based on what you have learned so far in Learning with Technology, have your practicum experience(s) been what you expected or not? Please explain.

5.10 / **Directions:** After reading the statement, circle the number that best represents your beliefs on the importance of the statement (from 0 to 5). Place a checkmark in the final column ("I already do this") if the statement reflects what you have done in the classroom.

	Not applicable	Not at all important	Not very important	Neutral	Somewhat important	Extremely important	I already do this
Integrate technologies other than a word processor (e.g., Microsoft Word) or a presentation tool (e.g., MS Powerpoint) into your teaching.	0	1	2	3	4	5	☐
Provide students with an opportunity to use their own technologies during class time.	0	1	2	3	4	5	☐
Critically evaluate the technologies that you are required to use in your teaching.	0	1	2	3	4	5	☐
Critically evaluate the technologies that you are provided with in your school facilities.	0	1	2	3	4	5	☐
Keep up with the technologies that your students are using outside of the classroom.	0	1	2	3	4	5	☐
Work alongside students to evaluate how emerging technologies work as learning and teaching tools.	0	1	2	3	4	5	☐
Read blogs.	0	1	2	3	4	5	☐
Post comments on others' blogs.	0	1	2	3	4	5	☐
Maintain (regularly) your own blog.	0	1	2	3	4	5	☐
Provide students with opportunities to create multimodal texts (e.g., digital stories, digital videos, digital book trailers).	0	1	2	3	4	5	☐
Require students to use and cite online sources when researching a topic.	0	1	2	3	4	5	☐
Discuss online searching strategies with students prior to using online sources.	0	1	2	3	4	5	☐
Listen to podcasts.	0	1	2	3	4	5	☐
Provide students with opportunities to create and upload their own original online content.	0	1	2	3	4	5	☐

5.10 (continued)

	Not applicable	Not at all important	Not very important	Neutral	Somewhat important	Extremely important	I already do this
Provide students with opportunities to interact with authentic audiences online.	0	1	2	3	4	5	☐
Model responsible practices and uses of technology and the Web for your students.	0	1	2	3	4	5	☐
Collaborate with other teachers or students to design technology-infused curricula or assignments.	0	1	2	3	4	5	☐
Learn new strategies and tools for effectively integrating technology into your teaching.	0	1	2	3	4	5	☐
Belong to a Personal Learning Network (PLN) that focuses on emerging technologies.	0	1	2	3	4	5	☐
Participate in professional development on emerging technologies.	0	1	2	3	4	5	☐
Meet with members of your department or division on a regular basis to discuss how emerging technologies can be used.	0	1	2	3	4	5	☐
Meet with members of other departments to discuss how emerging technologies can be used.	0	1	2	3	4	5	☐
Read current and ongoing research on emerging technologies in schools.	0	1	2	3	4	5	☐
Keep up with current policies regarding emerging technologies in your school and school board.	0	1	2	3	4	5	☐

Adopted from Beers', Probst's, and Rief's 'What Counts in Teaching English with Technology?' survey (Beers, Probst & Rief, 2007, p. 381).

Please provide any additional comments in the space below:

APPENDIX F: Presentation script

Hello everyone, I am Noelle Morris from the Faculty of Education.

I am looking for volunteers to participate in my final thesis project called "Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities". I will be conducting a questionnaire and a focus group interview that will investigate the different factors that affect what you learn in your Learning with Technology class, as well as how you have experienced technology in your practicum experiences. All of the data will be collected by the end of January.

You have the option of participating in the questionnaire and/or the focus group. You will have to complete the questionnaire and focus group outside of class time, but I am interested to get feedback on the experiences that you have had thus far this year. Your input is extremely valuable to future research and decisions within the Faculty of Education.

I have outlined the potential risks and benefits in the Letter of Information, which I have given to you. I have also outlined how to withdraw from participating, and all issues pertaining to confidentiality.

If you choose to participate, your name will be put into a draw for one of two $50.00 gift certificates to the Keg. The ballot is at the bottom of the consent form.

If you would like to participate in the questionnaire, please pick up a consent form and questionnaire at the front of the class. I will be back on (insert date here) to pick up the questionnaires before class begins. If you aren't here on that day, you can email me at morris1b@uwindsor.ca and we can arrange for an alternative way to submit the consent form. The questionnaires will take approximately half an hour to complete, and you don't have to answer or make notes on every question. If you need a digital copy for accessibility purposes, please email me at morris1b@uwindsor.ca.

APPENDIX G: Audio consent form

CONSENT FOR AUDIO TAPING
(Teacher Candidate Participant)

Research Subject Name: _____

Title of the Project: Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

I consent to the audio taping of focus group interviews.

I understand that these are voluntary procedures and that I am free to withdraw at any time. I also understand that my name will not be revealed to anyone and that taping will be kept confidential. Tapes are filed by number only and stored in a locked cabinet.

I understand that focus groups are group events and have increased risks. Focus group methodology carries with it implications for confidentiality. I understand that confidentiality will be respected and that the audiotape and subsequent notes will be for professional use only. I will consider any and all information disclosed by other participants and/or the facilitator to be confidential in nature.

_____
(Name of Participant)

_____ _____
(Signature of Participant) (Date)

APPENDIX H: Interview fieldnotes form

Interview Protocol: Interview Questions for Teacher Candidates

Project: Learning and teaching with emerging technologies: Preservice pedagogy and classroom realities

Time of discussion:

Date:

Place:

Interviewer:

Interviewee(s):

- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____
- ❑ Pseudonym:_____ Division: _____

Introduction:

1. The interviewee(s) will be told about the (a) purpose of the study, (b) individuals and sources of data being collected, (c) what will be done with the data to protect the confidentiality of the interviewee, and (d) how long the discussion will take.
2. The interviewee will read and sign the Audio Consent form.
3. The audio recorder will be turned on and tested.

Questions: *(from Appendix I)*	**Notes:**

APPENDIX I: Interview questions (prepared and improvised)

Placement:

- Based on what you have learned so far in the required technology class, have your placement experiences been what you expected or not?
- Did you have any really good or really bad experiences with technology in your placements? Did you run into any problems or challenges with technology or the Internet?
- Did you feel that you were expected to use technology in your placement? By who?
- How did your mentor teachers use technology? Were you able to teach your mentor teachers anything about technology?
- Was there a difference in access to technology from classroom to classroom?
- How often did your students use technology in your placements?
- If you were able to use the SmartBoard in your placement, what did you use it for? Did your students use it as well?
- Do you assume that your students are technologically competent?
- Will you approach technology in your next placement differently as a result of your first placement?
- Did you ever feel overwhelmed? (planning lessons, figuring out how to integrate technology, etc.)
- What kind of risks are involved with ICT integration for preservice teachers?
- How important is it that you experience technology in your placements?

Technology class:

- What have you learned so far in your technology class?
- Is one technology course sufficient? Has the technology class addressed your own content area? Should there be technology courses for subject areas instead?
- Did you feel that you were more prepared to use ICT in the classroom because of the technology class?
- Do you feel more or less confident using technology in the classroom as a result of using technology outside of school?
- Do you believe that technology can enhance teaching and learning?
- Should a teacher be a knowledge authority or a knowledge facilitator?
- Do you feel like you have been given opportunities for professional development with technology in this program, above and beyond the technology class?
- Have you been able to help other teachers or your peers this year with your own technology knowledge?
- After being in the technology class, what technologies are you comfortable integrating into your own classroom? What technologies are you reluctant to integrate into your own classroom?
- Have you had any experience with assistive technologies this year, either in the Faculty or in your placement?

The broader faculty of education:

- In some Bachelor of Education programs, students are required to buy laptops with software at the beginning of the year that they use in every class. What are your thoughts on "forcing" B.Ed students to buy laptops from school and use them in every Faculty of Education class?
- Besides the technology class, have you seen technology modeled on a consistent basis by other professors in the Faculty of Education? How have they modeled technology use?
- What recommendations would you give to the Faculty of Education to increase your knowledge or experiences with technology, both in the Faculty and in your placements?

General:

- Do you believe that younger teachers are more tech-savvy? Does it really matter whether someone is a digital native or a digital immigrant?
- What kind of place should technology have in schools in the future (if money wasn't an issue)?
- If you are given the option of using a new technology tool or an older technology tool that you are comfortable with, what would you choose?
- What kind of factors would encourage you to bring technology into your classroom? Discourage? What are the barriers?
- Whose responsibility is it to ensure that students are effective and critical users of technology?
- Should schools have open access to the Internet?

VITA AUCTORIS

NAME: Noelle Morris

PLACE OF BIRTH: Mississauga, Ontario

EDUCATION:

St. Aloysius Gonzaga Secondary School
Mississauga, Ontario
2000-2004

Bachelor of Arts (English and Communications)
York University
Toronto, Ontario
2004-2008

Bachelor of Education (Intermediate/Senior)
York University
Toronto, Ontario
2009-2010

Master of Education (Curriculum Development)
University of Windsor
Windsor, Ontario
2010-2012