PREPARING ELEMENTARY PRESERVICE TEACHERS TO INTEGRATE INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING: EXPLORING THE INTENDED, ENACTED, AND EXPERIENCED CURRICULUM.

by

Robert Horgan

A dissertation submitted to the Graduate Program in Education in conformity with the requirements for the Degree of Doctor of Philosophy

Queen’s University

Kingston, Ontario, Canada

September, 2019

Copyright © Robert Horgan 2019
ABSTRACT

The goal of this case study was to understand and identify the supporting factors to prepare elementary preservice teachers to integrate information and communication technology (ICT) in teaching and learning. My interest in examining these factors lies within the context of the intended (what the University and/or Faculty of Education planned to do), enacted (what course instructors did to prepare and deliver their courses), and experienced (what preservice teachers reported that they learned) curriculum. Data were collected from 16 stakeholders associated with a Bachelor of Education program (primary/junior level) at a large Canadian university. Data collection included interviews with three participant groups (university administrators, course instructors, and elementary preservice teachers), researcher observations, and document analysis. The results of the qualitative analysis indicated that four key supporting factors for the integration of ICT in teaching and learning existed: Strategic curriculum, standardized technology, blended learning, and integrated learning. Findings further suggested that TPACK (Mishra & Koehler, 2006) might be envisioned as a prescriptive, rather than just a descriptive model, offering a preliminary look at effective processes to prepare preservice teachers. Finally, the results suggested that three key theoretical models: Ertmer’s (1999) First and Second Order Barriers to Technology Integration, Pumentedura’s (2006, 2009) Substitution, Augmentation, Modification, and Redefinition (SAMR) framework, and Mishra and Koehler’s (2006) TPACK model, might be best used in conjunction with one another to effectively prepare preservice teachers to integrate ICT in teaching and learning. Theoretical and practical implications, as well as limitations associated with this case study are discussed.
ACKNOWLEDGMENTS

There are a number of people at Queen’s that provided direction, assistance, and support in completing this dissertation. First to my supervisor, Dr. Peter Chin, and committee members, Dr. Theodore Christou and Dr. Denise Stockley, thank you for your advice and enduring commitment in seeing this through to the end. Second, to the staff at the Faculty of Education Library and Graduate Studies Office, the Writing Centre and Accessibility Services at Queen’s—your encouragement and advice have been critical in helping me move forward with my studies.

Finally, a number of people and organizations outside of Queen’s are deserving of praise in providing support to keep me focused on moving forward to the extent possible. Foremost, I would like to thank the participants who volunteered their time and shared their experiences with me. Without your cooperation, this study would not have been possible. Finally, I would like to acknowledge the following critical supports who aided me in my dissertation journey: the Brain Injury Association of Durham, the PHP program staff and clinicians at Ontario Shores, Mr. John Lunman, Dr. Wendy LeDoux, Dr. Kathryn Paterson, and Dr. Punya Mishra.
DEDICATION

This dissertation is dedicated to a number of people who supported me along this journey. First to my children: Spencer your persistence and tenacity to never quit has been an inspiration to me during times when I wanted to give up. Cassidy, your tremendous joy, zest for life, and willingness to experience new things was equally inspiring to keep moving forward at times when I felt stuck. Thank you. To my spouse, Sam, there are no words to describe my appreciation for your love and support over these years. Thank you for all that you’ve done. To my mom and dad, by your example, I have learned to go with the flow and trust that things will work out--they did, thank you. Finally, to my grandmother, Marte Horgan, your generous gift was the catalyst for completing my first degree in 2005. Your parting words to me the last day we said goodbye were encouraging and something that always stayed with me during difficult times completing this program.
# CONTENTS

ABSTRACT.................................................................................................................................ii

ACKNOWLEDGEMENTS.................................................................................................................iii

DEDICATION.................................................................................................................................iv

LIST OF TABLES .......................................................................................................................... ix

LIST OF FIGURES ......................................................................................................................... x

CHAPTER 1: INTRODUCTION .................................................................................................... 1

Dissertation Overview .................................................................................................................. 1

Key Terminology .......................................................................................................................... 5

Study Goals and Research Questions .......................................................................................... 8

Key Theoretical Frameworks ......................................................................................................... 9

Research Limitations, Delimitations, and Assumptions ............................................................... 11

Research Contributions ............................................................................................................... 15

Dissertation Organizational Structure .......................................................................................... 17

CHAPTER 2: LITERATURE REVIEW ......................................................................................... 19

Relevance and Benefits of ICT to Teaching and Learning .......................................................... 19

Challenges Associated with Integrating ICT in Teaching and Learning ..................................... 24

Theoretical Insights to Integrating ICT in Teaching and Learning .............................................. 27

Ertmer’s First and Second Order Barriers .................................................................................... 27

Technological, Pedagogical, and Content Knowledge .................................................................... 32

Substitution, Augmentation, Modification, Redefinition ................................................................ 36

Supporting Factors in Preparing Preservice Teachers to Integrate ICT .................................... 38

Standardized Technology ............................................................................................................. 39

Blended Learning Course Designs ............................................................................................... 42

ICT Integration in Teacher Education Programs ......................................................................... 44
Implication #3: SAMR, Because TPACK is Not Enough ................................................................. 132
Practical Implications .................................................................................................................. 137
Intended Curriculum .................................................................................................................. 137
Enacted Curriculum .................................................................................................................. 139
Experienced Curriculum ........................................................................................................... 141
Trustworthiness of the Findings ............................................................................................... 142
Credibility .................................................................................................................................. 142
Transferability ............................................................................................................................ 145
Dependability .............................................................................................................................. 146
Confirmability .............................................................................................................................. 147
Limitations and Future Research ............................................................................................... 148
Conclusion ................................................................................................................................... 150
References .................................................................................................................................... 153

APPENDIX A: RESEARCH ETHICS BOARD APPROVAL ......................................................... 171
APPENDIX B: LETTER OF INFORMATION - COURSE INSTRUCTORS ......................... 172
APPENDIX C: LETTER OF INFORMATION - PRESERVICE TEACHERS ....................... 174
APPENDIX D: LETTER OF INFORMATION - UNIVERSITY ADMINISTRATORS .... 176
APPENDIX E: CONSENT FORM - PRESERVICE TEACHERS ........................................... 178
APPENDIX F: CONSENT FORM – COURSE INSTRUCTORS .............................................. 180
APPENDIX G: CONSENT FORM – UNIVERSITY ADMINISTRATORS ............................. 182
APPENDIX H: SAMPLE INTERVIEW QUESTIONS – PRESERVICE TEACHERS ... 184
APPENDIX I: SAMPLE INTERVIEW QUESTIONS – COURSE INSTRUCTORS .... 186
APPENDIX J: SAMPLE INTERVIEW QUESTIONS – UNIVERSITY ADMINISTRATORS ................................................................................................................................. 189
APPENDIX K: EMAIL RECRUITMENT LETTER – COURSE INSTRUCTORS .... 191
APPENDIX L: RECRUITMENT LETTER – PRESERVICE TEACHERS ....................... 192
APPENDIX M: EMAIL RECRUITMENT LETTER – UNIVERSITY ADMINISTRATORS ............................................................................................................. 193
APPENDIX N: CONFIDENTIALITY AGREEMENT – RESEARCH ASSISTANTS..... 194
LIST OF TABLES

Table 1. Related Terms of ICT in Educational Contexts.......................................................... 7
Table 2. Overview of Results.................................................................................................. 74
Table 3. Overview of Strategic Curriculum Courses and Activities ......................................... 76
Table 4. Excerpt from Language Arts II Course Outline............................................................ 99
LIST OF FIGURES

Figure 1. TPACK model. Reproduced by permission of the publisher, © 2011 www.tpack.org. 10

Figure 2. A prescribed model for developing TPACK in a sequential learning design. ............ 16

Figure 3. Depiction of Shulman's (1987) PCK framework. .................................................. 33

Figure 4. Revised Venn diagram including the seven knowledge domains. ......................... 34

Figure 5. SAMR model. Puentendura © 2006 CC BY-NC-SA 3.0

(https://creativecommons.org/licenses/by-nc-sa/3.0/) ......................................................... 37

Figure 6. Sample slide from PowerPoint presentation for a Language Arts class: Discussion. . 101

Figure 7. Sample slide from PowerPoint presentation for a Language Arts class: Summary. ... 102
CHAPTER 1: INTRODUCTION

Dissertation Overview

Preservice teacher education programs have faced frequent and significant challenges in preparing new teachers to integrate information and communications technology (ICT) in teaching and learning since the emergence of the personal computer PC in the classroom (Abbitt, 2011; Allsopp, Alvarez McHatton, & Cranston-Gingras, 2009; Drummond & Sweeney, 2017; Kay, 2006; Tondeur, van Braak, Siddiq, & Scherer, 2016). The look of the elementary classroom has evolved over the years from the use of traditional low-technology (e.g., chalkboards, paper and pencil) to overhead projectors and multimedia devices (e.g., 8mm film, video disks, VHS tapes, cable television) to ever-evolving high-technology ICT (e.g., classroom computers with Internet access, learning management system software (LMS), iPads, digital microscopes). However, the availability of such high-technology does not necessarily translate into meaningful teaching and learning experiences, or even its use in the classroom (Chen & Looi, 2007). Simply put, there has been, and continues to be, a disconnect between the availability of 21st Century high-technology and the meaningful integration of high-technology ICTs in the elementary classroom (Ali, Salleh, & Shahrill, 2015; Funkhouser & Mouza, 2013).

I personally observed the challenges associated with this disconnect while teaching as a third-grade public school teacher in Las Vegas, Nevada. The school had a broadcast television studio and a computer lab. The classrooms were each equipped with mini-computer labs and large screen televisions. Additional ICTs were also available for classroom use (e.g., video cameras, audio recorders, cameras). Indeed, teachers had significant access to ICT. As a recent graduate of a preservice teacher education program, I was eager to apply my newly acquired pedagogical knowledge teaching social science, math, language arts, science, etc. making use of
all available ICTs. Surprisingly, the school’s sign-out inventory of ICT always seemed available. I learned that few teachers actually made use of the available ICTs. Appreciating the richness that ICT could bring to the teaching and learning experience, I was puzzled why my colleagues were not incorporating its use in their classrooms. I soon learned that many of my colleagues were unaware of how to use the various types of ICT, let alone how to effectively integrate ICT in classroom activities. Curious as to how widespread this lack of knowledge might be, I explored the ICT and teaching literature while completing my Master of Education. I learned that the lack of application of ICT in my Las Vegas public school was a common phenomenon. This inspired me to learn why such a gap existed between the availability and use of opportunities for effective ICT integration in teaching and learning.

There may be numerous reasons and contributing factors to explain why ICT is not integrated effectively into teaching and learning. For instance, the problem may lie with school boards not valuing ICT, with classroom teachers’ self-efficacy in using ICT, or with a lack of available funding for and training on how to effectively integrate ICT among preservice teachers. Indeed, there is a field of study in which it is argued that preservice teacher education programs should bear significant responsibility in sufficiently preparing their teacher candidates to learn how to effectively integrate ICT in teaching and learning (e.g., D’Agostino, Rodgers, Harmey, & Brownfield, 2016; Funkhouser & Mouza, 2013; Kay, 2006; Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2017). More specifically, the curriculum of preservice teacher education programs should aptly prepare teacher candidates to take advantage of all that ICT offers to the learning experience Häkkinen, Järvelä, Mäkitalo-Siegl, Ahonen, Näykki, & Valtonen, 2016). And so, my dissertation journey began.
Broadly, the focus of my dissertation is to better understand why ICT is not effectively integrated into teaching and learning activities in the classroom and to identify key supporting factors that can be used by important stakeholders (e.g., universities, teacher education programs, teaching Faculty, preservice teachers, practicum sites) in preparing preservice teachers to integrate ICT in teaching and learning. My goal was to build on three existing key theoretical frameworks: Ertmer’s (1999) First and Second Order Barriers, Mishra and Koehler’s (2006) Technological Pedagogical and Content Knowledge, and Puente’s (2006, 2009) Substitution, Augmentation, Modification, and Redefinition model. I did so by conducting a qualitative case study of relevant stakeholders in a Bachelor of Education program that ultimately enabled me to suggest a prescriptive model to guide the development of curricula for preservice teachers to effectively integrate ICT in teaching and learning in their future classrooms.

Curriculum can be understood in a variety of ways (e.g., Marzooghi, 2016). In the current work I explored the planned curriculum, the enacted curriculum, and the experienced curriculum, recognizing that some of the disconnect between the availability of, and use of, ICT among preservice teachers may result from discrepancies between academic stakeholder (e.g., program administrators, Faculty) intentions and actual experiences of preservice teachers. This model of curriculum is consistent with other interpretations of curriculum found in the education literature (Marzooghi, 2016; Matthews & Mercer-Mapstone, 2018). The planned curriculum includes teaching and learning activities, and the infrastructure required to carry out the teaching and learning activities (e.g., available ICT) that are planned for by the University and program administrators of preservice teacher education programs. The enacted curriculum includes the delivery of courses and teaching and learning activities facilitated by the course instructors (i.e., how the curriculum is delivered in preservice teacher education classrooms). The experienced
curriculum focuses on what preservice teachers report about their learning experiences in their teacher education program. Matthews and Mercer-Mapstone (2018) note the importance of investigating and understanding curriculum from the perspectives of planners (i.e., university and program administrators), enactors (i.e., course instructors), and students (i.e., preservice teachers). More specifically, they designed their study to investigate how perceptions of science undergraduate student experiences compare to the experiences of the planned curriculum, drawing on the perspectives of academic administrators and course instructors. Expanding on this, in the current study, I explored the perspectives of university administrators, course instructors, and preservice teachers on the planned, enacted, and experienced curriculum.

Deconstructing curriculum as planned, enacted, and experienced enables a comprehensive investigation (including the perspectives of multiple stakeholders) of the existing supporting factors that prepare preservice teachers to integrate ICT into teaching and learning activities.

I collected data for this dissertation from a preservice teacher education program at a Canadian university over the course of a single term. Given the novelty of the research questions and the need to generate a deep understanding, a qualitative methodology was most appropriate (Bailey, 2007; Patton, 2002). Specifically, I collected relevant data from interviews with university and program administrators, course instructors, and preservice teachers. Supplemental information was collected through participant observation and program/course documentation. I used qualitative analyses to review the data by identifying and categorizing the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning. Guided by existing theoretical frameworks, the data were further analyzed to assess connections among the planned curriculum, the enacted curriculum, and the experienced curriculum. Further details of
the methodology and analysis are discussed in Chapter 3. In the following section, I present definitions associated with the terminology used in this dissertation.

Key Terminology

“Preservice teachers” refers to university students enrolled in a full-time Bachelor of Education (B.Ed.) teacher education program. My study specifically focused on a teacher education program that led to certification to teach elementary school (Kindergarten to Grade 6) by the provincial regulatory agency within the province that the university was located. As such, any reference to preservice teacher or teacher candidate refers to a Bachelor of Education student at the research site working toward certification to teach elementary grade levels.

The terms teaching and learning are related, yet distinct. For the purposes of this investigation, teaching refers to the actions of the course instructor to deliver the course curriculum (i.e., what the instructor does). Examples of teaching include lecturing, facilitating small-group activities and/or discussion, assigning and discussing readings, prompting critical reflection, and communicating with preservice teachers (electronically or face-to-face). In contrast, learning refers to the actions of the student in acquiring the related knowledge, skills, and abilities of the course curriculum. Examples of learning activities include making notes during lectures, communication (electronically or face-to-face) with other students about coursework, listening and sharing during small-group discussions, actively reading and reflecting on assigned readings, and sharing reflections with course instructors about their experiences. In this work I recognize that not all students learn the curriculum content directly from teaching activities. In fact, many students may learn the curriculum content irrespective of the actions of their course instructor. As such, in this research I explore supporting factors to prepare preservice teachers to integrate ICT in teaching and learning that are both teacher-based (i.e., focused on
specific teaching strategies) as well as learner-based (i.e., focused on specific learning activities that the preservice teachers engaged in).

Further, the terms “teaching” and “learning” are nested in a complex structure wherein preservice teachers are learners within the B.Ed. program subject to the teachings of the course instructors as they prepare the preservice teachers to become educators of their own classes of learners. To understand the phrase, ‘preparing preservice teachers to integrate ICT in teaching and learning’ is to understand that preservice teachers are learning how to integrate ICT in teaching their own classes (e.g., lesson planning, micro-teaching), during their practica and following graduation while making use of ICTs for their own learning in the B.Ed. program.

As noted above, the term ICT refers to information and communication technology. For the purposes of this study, ICT requires a specific definition as it is not clearly defined or discussed in the literature (Lakhana, 2014). I broadly define ICT as any computer-related technology that is used in teaching and learning. This definition is broad enough to include hardware technologies (e.g., laptops, digital cameras, interactive whiteboards and digital projectors for presentation, digital thermometers, wireless routers for Internet access) as well as software technologies such as learning management system (LMS) software programs preinstalled on the laptop, and applications used on a smartphone and websites. Indeed, there a multiple names and terms for ICT integration in educational contexts noted in various academic journals and trade publications. Examples of such terms appear in Table 1.
Table 1

<table>
<thead>
<tr>
<th>Term</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>EdTech</td>
<td>EdTech Magazine</td>
</tr>
<tr>
<td>Technology in Education</td>
<td>Journal of Technology in Education</td>
</tr>
<tr>
<td>Information Technology</td>
<td>Journal of Technology and Teacher Education</td>
</tr>
<tr>
<td>E-Learning</td>
<td>The Electronic Journal of e-Learning</td>
</tr>
<tr>
<td>Online Learning</td>
<td>Online Learning Journal</td>
</tr>
<tr>
<td>Learning Technology</td>
<td>International Journal of Learning Technology</td>
</tr>
<tr>
<td>Computer-Assisted Learning</td>
<td>Journal of Computer Assisted Learning</td>
</tr>
</tbody>
</table>

There are subtle differences among some of the terms noted above. For example, some terms imply the process of learning with various technologies such as online learning or e-learning referring to the process of or the how of learning activities take place and the environment in which the learning takes place (i.e., through accessing resources online via the Internet). Other terms such as educational technology refer to the what. For example, various forms of technology in the classroom that may include low-technology (e.g., pencil and paper, physical manipulatives, optical microscopes) as well as high-technology (e.g., use of computers, digital multimedia including audio and video, software). The definition of ICT for this study is more focused on high-technology that includes any computer-related technology that is used in teaching and learning. Indeed, many of the terms such as e-learning, online learning, computer assisted learning, etc. are related to this study. However, for the purposes of clarity and consistency, it was important to define ICT specifically as high-technologies (i.e., the what) in
order to identify the supporting factors (i.e., the how), which include online learning activities, blended learning, etc.

**Study Goals and Research Questions**

This dissertation contributes to exploring the complex problem of how to effectively teach ICT integration to preservice teachers. The primary purpose of this research is to understand and identify the supporting factors that prepare elementary teacher candidates to integrate ICT in teaching and learning. It relies on qualitative methods (personal interviews, classroom observations, and document analysis) to identify supporting factors as discussed by the participants (university and program administrators, course instructors, and preservice teachers) in an ICT-rich Canadian teacher education program that is rooted in a mandatory laptop-based curriculum. Three key areas of curriculum are explored, each with a guiding research question to identify supporting factors:

1. **Intended Curriculum**: What steps does the University take to prepare preservice teachers to integrate ICT in teaching and learning?

2. **Enacted Curriculum**: How do course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning?

3. **Experienced Curriculum**:
   a. How do preservice teachers learn how to integrate ICT in teaching and learning?
   b. To what extent do preservice teachers develop and apply technological and pedagogical knowledge to integrate ICT within their practicum?

With regard to research question three, part a focuses on how preservice teachers learn in class, whereas part b focuses on whether they apply their knowledge during practicum.
Key Theoretical Frameworks

My research relies on three theories of ICT integration to make sense of the planned, enacted, and experienced curriculum: a) Ertmer’s (1999) First and Second Order Barriers, b) the Technological, Pedagogical, and Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), and c) the Substitution, Augmentation, Modification, and Redefinition (SAMR) model (Puentedura, 2006, 2009).

Ertmer’s (1999) First and Second Order Barriers model was used as a lens to primarily understand the supporting factors that university administrators and instructors overcame to provide access to, and facilitate the use of, ICT within the Faculty of Education. First order barriers include access to ICT in a physical sense (e.g., standardized technology throughout the B.Ed. program, interactive whiteboards, digital microscopes, Wi-Fi throughout the campus). Second order barriers include facilitating learning experiences to teach preservice teachers how to use various ICTs, and more importantly, how to use them in a pedagogical way to enrich the learning experience. Other second order barriers include instructors’ and preservice teachers’ self-efficacy and comfort in using the ICT, classroom management concerns, and developing a dynamic vision for the appropriate use of ICT in teaching and learning activities.

TPACK (Mishra & Koehler, 2006) is a descriptive model that identifies technology, pedagogy, and content knowledge as interdependent domains of teacher knowledge that lead to the appropriate integration of ICT in teaching and learning as depicted in Figure 1. Mishra and Koehler developed the TPACK framework as a means of critiquing teacher education programs on their capacity to prepare preservice teachers to integrate ICT in teaching and learning. The framework highlights the importance of developing technology, pedagogy, and content knowledge in relationship to each other instead of developing them independently as separate
courses or as separate domains. Figure 1, below, displays Mishra’s and Koehler's TPACK framework as a Venn diagram that illustrates seven distinct knowledge domains: Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological, Pedagogical, and Content Knowledge (TPACK).

![TPACK Model](image)

*Figure 1. TPACK model. Reproduced by permission of the publisher, © 2011 www.tpack.org.*

The SAMR model (Puenteleda, 2006, 2009) is useful in assessing the quality of technology integration in preservice teacher education programs. That is, this model measures the quality of how university educators integrate ICT in the delivery of course content. As such, the SAMR model is an evaluative tool to categorize the use of ICT in the four domains (i.e., Substitution, Augmentation, Modification, and Redefinition).
I initially thought that the TPACK framework (Mishra & Koehler, 2006) would form the basis of the major analyses conducted in this research. However, I found that Ertmer’s (1999) First and Second Order Barriers and the SAMR (Puenteledura, 2006, 2009) framework significantly informed my understanding in answering the research questions and identifying the supporting factors spanning the planned, enacted, and experienced curriculum. All three frameworks are discussed further in Chapter 2.

**Research Limitations, Delimitations, and Assumptions**

This dissertation focuses on identifying the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning at a B.Ed. program in a Faculty of Education that spanned two academic terms. The Faculty of Education program I studied offered two programs leading to certification in either primary/junior (kindergarten-grade six) or intermediate/senior (grades 7-12). I narrowed the scope of the study to examine only the primary/junior curriculum and recruited only course instructors and preservice teachers directly associated with the primary/junior B.Ed. program. I placed these parameters to immerse myself within one program curriculum rather than split my time and focus across two programs. More importantly, I believe that the limitation of researching one specific program increased the richness of the study and increased the transferability of the findings to other primary/junior and elementary preservice teacher education programs. As such, the findings of this study are best suited to B.Ed. programs focused on educating and preparing preservice teachers that intend on working within an elementary school setting. However, consideration should be given to the results of this study with respect to the practical implications for teacher education programs (both preservice and in-service teacher environments).
This study took place over the course of a single term. Although additional data could have been gathered had I used both terms spanning the full academic year (i.e., September-April), much of this information would have been redundant as there is no reason to suspect that the supports for integrating ICT would differ dramatically across terms. As such, I chose to collect data during the second term (January-April) when participants already had rich experiences to draw on from the first term (September-December). Specifically, I was able to gather participant perceptions regarding what had happened during the first term and what was happening during the second term. Indeed, all participants shared stories or referred to curriculum-related activities from the first term in addition to the second term when I conducted the study. As explored in Chapter 4, the data support the choice to collect data in a single term and suggest that this methodological limitation will not compromise transferability of the findings for primary/junior curricula.

Restricting data collection to one term also played a role in limiting the number of participants in the study. To allow ample time for class observations, interviews, transcription, participant-checking, and the potential for follow-up interviews, I originally planned to interview three university and B.Ed. program administrators, three course instructors, and five preservice teachers. Ultimately, I expanded the number of university and program administrator interviews to eight. A need to gather additional data arose during data collection (i.e., from suggestions of the course instructors and preservice teachers) and upon learning that the delimitations of the study had precluded the inclusion of key Faculty members. As such, although I was unable to observe a tenured or tenure-track Faculty member teach a course during the data collection term, I interviewed four tenure/tenure-track Faculty members who served in an administrative capacity to ensure that the voices of tenure and tenure track Faculty were also heard.
I also placed a delimitation on recruiting course instructors who taught a core elementary curriculum course (as opposed to intermediate/senior curriculum course instructors). Core elementary curriculum courses included Language Arts, Mathematics, Science & Technology, Social Studies, Physical Education and Health, Visual Arts, Drama, and Music. Due to limitations on time and resources, I initially limited the courses to Language Arts, and Mathematics. In my classroom teaching experience, Literacy (i.e., language arts) and Numeracy (i.e., math) were critically important courses as they were the two primary subject matter courses that elementary students were evaluated on through state and provincial criterion-referenced tests administered in Nevada and Ontario (also used in British Columbia, Alberta, Nova Scotia, and other Canadian provinces). Science and Technology and Social Studies courses were also a part of this study. I was keen to see what type of ICTs were used in support of teaching and learning the Science and Technology curriculum course. I was fortunate to have one course instructor-participant who taught Language Arts as well as Social Studies. As a result, I researched a total of four different courses (Math, Science and Technology, Language Arts, and Social Studies) taught by three course instructors. Therefore, neither specialized courses (e.g., special education, second language learners, outdoor education) nor professional skills courses (e.g., classroom management, the teaching profession) or other curriculum courses (Physical Education and Health, Visual Arts, Drama, Music) were considered.

Another limitation to note is that I did not explicitly measure preservice teachers’ knowledge, skills, or abilities in integrating ICT in this research. That is, there was no formal measure or assessment of ICT integration. I assumed that ICT integration was taking place at some level. Indeed, I witnessed various examples of ICT integration throughout my observations. These included preservice teachers using their laptops to access the LMS, use of
instructional videos, online math games for self-directed learning, and more. I focused this study to understand the supporting factors that prepare preservice teachers to integrate ICT with appropriate pedagogy in their subject-matter courses. Such evidence was provided by preservice teachers in the form of assignments and other learning activities they chose to share with me through stories and/or providing examples of their work.

Related to the aforementioned limitations, there are some major assumptions that guided my research that should be acknowledged. I am biased as a researcher and assume that there is a need for preservice teachers to be sufficiently prepared to integrate ICT in teaching and learning. My passion for computers and ICT fuels my inspiration for this study and certainly informed my observations, field notes, interpretations, and analysis of the data.

Thus, this dissertation proceeds on the assumption that students and teachers benefit from the integration of ICT in teaching and learning. The literature offers no clear winner on the debate regarding the integration of ICT in teaching and learning. Some perspectives argue that there is “no significant difference” (e.g., Shelton, 2017), others argue that ICT integration should be the new standard in teaching (e.g., Baran, Canbazoglu Bilici, Sari, & Tondeur, 2017; Jaipal & Figg, 2015; Tondeur et al., 2017), and other perspectives purport that good learning comes from good pedagogical teaching, whether or not ICT is integrated (Marsh & Arthur, 2014; Joy & Garcia, 2000). This debate is discussed in further detail in Chapter 2. I agree with many of the arguments that ICT can be more of a hindrance than a help, and that the integration of ICT as novelty or “edutainment” has no real impact on learning. However, I question whether past studies were conducted with teachers who were skilled with both ICT knowledge and skills and the effective pedagogical use of ICT in teaching and learning. As such, I believe that preservice
teachers should be reasonably prepared to integrate ICT in teaching in learning prior to evaluating the effectiveness of ICT being integrated in the classroom.

In the context of my research, I also assumed that the preservice teachers at the teacher education program were being prepared to integrate ICT in teaching and learning to some extent, given that this was a major goal of the University (e.g., the University espoused the value of ICT through their commitment to the use of standardized laptops). Further, this assumption was based on comments from teacher-educator colleagues in the field and from information about the B.Ed. program provided on the participating Faculty of Education website. The website highlights some of the benefits of the program, including learning about innovative teaching practices with technology and the development of ICT-based skills over the course of the academic year. The veracity of the assumption that preservice teachers are actually prepared to integrate ICT in teaching and learning is supported through the voices of the preservice teachers and course instructors as discussed in Chapter 4.

**Research Contributions**

This research makes some important theoretical and practical contributions to the literature and to teacher education programs. First, the results of this study address a gap in the literature about the effective preparation of preservice teachers to integrate ICT in their instruction (Abbitt, 2011; Drummond & Sweeney, 2017; Kay, 2006; Tondeur et al., 2016). In Chapter 5, I highlight the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning and then discuss the practical and theoretical implications of these results.

Second, the study’s findings suggest that TPACK might be useful as prescriptive framework (rather than as a descriptive one), in preparing preservice teachers to integrate ICT in teaching and learning. This prescriptive model is depicted in Figure 2 and suggests that
preservice teachers might benefit from developing core TPACK knowledge domains (e.g., TL, PK, and CK) prior to developing the combined knowledge domains (TPK, PCK, and TPACK).

Figure 2. A prescribed model for developing TPACK in a sequential learning design.

Third, this research underscores the usefulness of a tri-theory perspective to prepare preservice teachers to integrate ICT in teaching and learning. Ertmer’s (1999) First and Second Order Barriers can be used to identify the supporting factors primarily for planned and enacted curriculum. The TPACK (Mishra & Koehler, 2006) framework can be used as a prescriptive model to plan the curriculum (i.e., having a systematic means of developing technological knowledge to utilize ICT in a pedagogical way within specific subject matter courses). Also, the TPACK framework can be used as a descriptive model to explain the complex knowledge of integrating ICT in teaching and learning by course instructors and preservice teacher. The SAMR model can be used to discuss and assess the quality of the TPACK integration enacted by course instructors and preservice teachers on practicum. The results of this study suggest that these three
theoretical frameworks are complementary and should be used collectively to effectively prepare preservice teachers to integrate ICT in teaching and learning.

Dissertation Organizational Structure

Chapter 1 framed the study within the field of preservice teacher education and presented the problem of ICT not being used effectively in the classroom. As well, this chapter outlined the purpose of my dissertation: investigation of the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning by looking at the planned, enacted, and experienced curriculum of a preservice teacher education program.

Chapter 2 draws on the extant literature to present a discussion about the need for ICT integration in the classroom as well as the opportunities and challenges associated with ICT integration. I discuss, in detail, the three theoretical frameworks relevant to this goal. Finally, I identify a gap in the literature that I argue might be addressed by reframing TPACK as a prescriptive, as opposed to descriptive, model for preparing preservice teachers to integrate ICT in teaching and learning. Figure 2 visually reimagines the TPACK framework as a more hierarchical model rather than as a Venn diagram. Indeed, the results of my study suggest that TPACK can be utilized as a prescriptive model where the individual knowledge domains of TK, PK, and CK, are developed first before moving on combined knowledge domains of TPK, PCK, and ultimately, TPACK. The findings of this study suggest that this may occur within individual courses, as well as across courses within a strategic curriculum.

Chapter 3 describes the methodology and research methods used in this case study. As noted previously, qualitative data were collected from participants associated with a single preservice teacher education program at a Canadian university over the course of a single term.
Chapter 4 presents the results of the study. Qualitative data analysis methods were used to identify and categorize the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning. The data were further analyzed to assess connections among the planned curriculum, the enacted curriculum, and the experienced curriculum, relative to relevant theoretical models (i.e., Ertmer’s 1999 First and Second Order Barriers, TPACK, and SAMR). The presentation of results is organized according to the Planned Curriculum, the Enacted Curriculum, and the Experienced Curriculum, with each grouping containing the perspectives of university and program administrators, course instructors, and preservice teachers.

Chapter 5 summarizes the key contributions of this study and details the theoretical and practical implications of the results. In particular, the results of this study suggest that the simple development of TPACK may not be sufficient to effectively prepare preservice teachers to integrate ICT in teaching and learning. Consideration of the study findings with regard to Ertmer’s First and Second Order Barriers, TPACK, and SAMR, suggest that a prescriptive TPACK model that integrates the principles of these three key theories may be most useful in informing preservice teacher education programs with respect to the planned, enacted, and experienced curriculum.
CHAPTER 2: LITERATURE REVIEW

This chapter situates my dissertation within the research literature of integrating ICT in teaching and learning. First, I introduce the known relevance and benefits of ICT to teaching and learning in the classroom. I then discuss common challenges identified in the literature as being associated with ICT integration in teaching and learning. I then review three key theoretical frameworks that I identified as being particularly relevant to the effective integration of ICT in teaching and learning. Finally, I review the literature in defining curriculum to include the intended, enacted, and experienced perspectives to support the guiding research questions that direct this study. This chapter concludes with a statement about how my dissertation builds on the existing knowledge on ICT and teaching and learning.

Relevance and Benefits of ICT to Teaching and Learning

The relevance of ICT to teaching and learning and importance of effective ICT integration has grown significantly over the past few decades (e.g., Yang, Tzuo, Higgins, & Yon Tan, 2012). Schools have gone from providing a Commodore PET computer wheeled between classrooms to use of computer labs, educational software, interactive whiteboards, and handheld devices (e.g., Luo & Yang, 2016). More recently there has been a trend toward encouraging students to bring their own ICT devices (e.g., smartphones, tablets, laptops) to assist with in-class learning. Indeed, there is a growing relevance of ICT in teaching and learning as ICT becomes more prevalent in society (Buabeng-Andoh, 2012; Mouza, Karchmer-Klein, Nandakumar, Ozden, & Hu, 2014; Niess, 2011; Song, 2014). Further, this relevance is recognized in government, school board policies, and regulated professional standards (e.g., Hutchison & Reinking, 2011). Clearly, ICT is significantly more than a short-lived fad and is, in fact, an ever-present reality of daily life (Figg & Jaipal, 2012). Rather, ICT has its underpinnings
rooted in almost all facets of social life from business (e.g., Internet banking, online retailers) to communications (e.g., email, texting and Internet access on smartphones) and government services (e.g., filing taxes, Internet voting). Indeed, the integration of ICT in schools can be reasonably expected to reflect the integration of ICT in the digital economy.

A sampling of the provincial government's curriculum documents, local school board policies, and guidelines from provincial teacher regulation entities underscore the relevance of ICT for teaching and learning in the classroom. Such documents establish clear professional expectations for educators. For example, with regard to curriculum guidelines going back as far as 2006, the Ontario Ministry of Education stated that “students should be encouraged to use ICT to support and communicate their learning” (p.30). Curriculum documents from other provincial governments state similar expectations (Province of Nova Scotia, 2015; Saskatchewan Ministry of Education, 2010). Beyond curriculum documents, some provincial governments in Canada highlight the expectation for teachers to integrate ICT in teaching and learning. For example, the Government of New Brunswick sets clear expectations for the integration of ICT and the related knowledge to do so stating, “Teachers know and understand student-centered pedagogies and how to integrate current and emerging information communication technologies (ICT) to meet the learning needs of 21st Century students in an inclusive education setting” (Government of New Brunswick, no date). Undoubtedly, these expectations are reasonable in light of the benefits and opportunities afforded by the effective integration of ICT and the ubiquitous presence of ICT in public schools.

Similarly, local school boards have both explicit and implicit policies regarding the integration of ICT in the classroom. For example, the Toronto District School Board (2007) explicitly states grade-level standards for specific media tools (e.g., digital cameras, handheld
devices) to be used in the classroom as well as specific media-related knowledge, skills, and abilities that students should demonstrate (e.g., participate in online learning, social media, and video conferencing). However, not all school boards may have such explicit policies published in school board documents as the Toronto District School Board. The ICT policies of some school boards may be more implicit, implied by the ubiquitous presence and use of ICT in the classroom (e.g., interactive whiteboards, Wi-Fi Internet access, classroom laptop/iPad carts), which, if used by students and/or the teacher, require ICT to be integrate in classroom teacher and learning activities.

Findings within the field of ICT in teaching and learning indicate that students experience significant benefits and opportunities with the integration of ICT. Numerous studies in various contexts have shown that ICT has a positive impact on student achievement (Livingstone, 2012; McEwen & Dubé, 2015; Waxman, Lin, & Michko, 2003). Evidence indicates that the use of computers for writing improves writing quality, overall student motivation and engagement among students (Hughes, 2013). Other studies have shown that students who used word processing software programs tended to be more engaged in the writing process (D’Agostino, Rodgers, Harmey, Bromfield, 2016; Yackanicz, 2000), worked more collaboratively with peers in editing each other’s work (Baker & Kinzer, 1998), and expressed higher positive attitudes toward writing (Goldberg, Russell, & Cook, 2003). A recent study by Rohatgi, Scherer, and Hatlevik (2016) found that grade nine students’ self-efficacy and achievement increased with the effective integration of ICT to develop basic computer and information literacy. Further, the use of ICT as a peer-focused collaborative ICT tool (Write to Learn) demonstrated that students significantly achieved higher standardized test scores in math and literacy compared with a control group of students without access to the collaborative ICT
tool (Genlott & Grönlund, 2016). Students also benefit from increased autonomy and individualization of instruction. Rabah (2015) noted that the integration of ICT in classroom activities facilitated more autonomy for students to choose various ICTs to help them plan out, organize, demonstrate, and share their learning with others in a manner that was consistent with their learning needs. Clearly, there are tremendous benefits possible for students when ICT is effectively integrated into classroom teaching (Cooley & Johnston, 2001; Mishra & Koehler, 2003; Shelton, Archembault, & Hale, 2017).

In addition to benefiting students, ICT also offers value to educators. For instance, in-service teachers reported benefits of integrating ICT in teaching and learning related to classroom management. One study found that teachers who regularly integrated ICT in their teaching practice reported increased student attention and engagement during lessons. This benefits the teacher by decreasing the need to attend to undesirable student behaviour and by improving the ease of classroom management (Uluyol & Şahin, 2016). In-service teachers from this study also reported enhanced and more immediate access to resources (e.g., lesson plans, worksheets, and media-rich content for classroom learning activities). Those teachers integrating ICT in their classroom on a regular basis realized efficiencies in their planning time by integrating technology into their teaching and learning activities.

Brasiel, Jeong, Ames, Lawanto, Yuan, and Martin (2016) conducted a study on the benefits of an individualized ICT-based mathematics program. The results of this research reinforced the fact that student benefits translate into teacher benefits. Students were able to better work independently and at their own pace, thus providing teachers with greater time to devote to individualized instruction, particularly for struggling students. Teachers in this study also benefited from the integration of automatic feedback to students. For example, teachers did
not end the day with a pile of papers and worksheets to review, grade, and provide feedback on. This was accomplished through automation; efficiencies were realized for teachers (as well as students) because the integration of ICT enabled immediate and automatic feedback to students. In some cases, teachers reported efficiencies in students independently retaking certain modules of the ICT-based mathematics program for further practice, relieving the teacher from having to provide remedial instruction. The level of student autonomy is implied clearly in this study as students worked independently through the mathematics program, received individualized instruction at their own pace, and received automatic feedback.

Despite the aforementioned benefits of ICT in teaching and learning to both students and teachers, an accurate representation of the field must recognize that some contradictory findings exist in the literature and some criticism has been directed at the application and use of ICT in teaching and learning (Cuban, 2001; Meggiolaro, 2018; Schrum, Thompson, Sprague, Maddux, McAnear, Bell, & Bull, 2005). For instance, some empirical studies failed to find significant positive effects of technology integration and modes of delivery (e.g., online learning, traditional face-to-face, and hybrid models) on student outcomes (Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011). Indeed, some empirical studies have demonstrated little or no positive effect of ICT integration on learning (Dybdahl, Shaw, & Blahous, 1997). One quasi-experimental study reported no statistically significant difference in test scores between an experimental group of students learning independently with an app on a handheld device and a control group of students learning with their whole class as part of traditional, teacher-led instruction (Furió, Juan, Seguí, & Vivó, 2015).

In another study, although Elstad and Christophersen (2017) acknowledged some positive benefits to the integration of ICT in teaching and learning, they also reported some challenges.
These researchers found that ICT-integrated teaching and learning activities were a benefit, but only to highly motivated students. However, this group of highly motivated students were the minority, with the majority of the class having problems staying focused on learning the subject matter content. In this study, the ICT-integration was shown to be a distraction for students and it presented challenges for the teacher to manage the classroom appropriately.

Despite its recognized relevance among governments and school boards, and its well-documented benefits to teachers and students, the preceding review suggests that ICT itself is not a panacea. Some argue that it may not be the technology itself that is failing to deliver, rather, it may be the manner in which the technology is integrated into the classroom that is problematic (Louw & Michau, 2018; Ringstaff & Kelley, 2002; Sclater, Sicoly, Abrami, & Wade, 2006; Zipke, 2018). As with any other teaching tool, ICT needs to be integrated in a purposeful and pedagogically sound way to be effective, as demonstrated by meaningful student learning (Figg & Jaipal-Jamani, 2009). In the following section, I discuss some of the particular challenges that have been associated with integrating ICT in teaching and learning in the literature.

**Challenges Associated with Integrating ICT in Teaching and Learning**

There are numerous challenges associated with effectively integrating ICT in teaching and learning. A primary challenge is having access to ICT in the classroom. Warschauer, Knobel, and Stone (2004) found that there was a digital divide in terms of ICT access between schools in high and low socioeconomic areas. They reported a significant relationship between socioeconomic area and ICT access, with those from higher socioeconomic areas having higher access to ICT in schools, and lower socioeconomic areas having lower access. Further, they found that teachers at schools in higher socioeconomic areas were more likely to integrate available ICT as compared to those at schools in lower socioeconomic areas. Given the
significant technological advancements since Warschauer et al. (2004), it is unclear whether this
digital divide still exists. Findings in the literature suggest it does, although it may present itself
in various ways.

A longitudinal study by Hohlfeld, Ritzhaupt, Dawson, and Wilson (2017) tracked the
digital divide between high and low socioeconomic areas and found no significant differences in
access to ICT in schools. The majority of the schools had sufficient access to ICT, regardless of
the area in which it was located. However, these scholars reported a digital divide in how ICT
was being used in the classrooms. Teachers at schools in high socioeconomic areas were more
likely to integrate ICT in more meaningful and creative ways and students were more likely to
use ICT to produce digital representations of their learning. In contrast, teachers at schools in
low socioeconomic areas were more likely to integrate ICT as a substitution for teacher-led
remedial learning activities (e.g., drills and practices).

Although the causes of the differences in ICT use among individuals in high and low
socioeconomic areas were not explored, two possible explanations might be offered. Teachers
from low socioeconomic areas may opt to use ICT for simple substitution because they are aware
that many of their students do not have access to technology at home (e.g., to finish assignments,
homework). In contrast, teachers from high socioeconomic areas may use ICT in more complex
and meaningful ways (e.g., internet search assignments, discussion board chats) because they are
confident about their students’ access to technology. Alternatively, given the desirability of
working in schools located in high socioeconomic areas (e.g., ample school resources), such
schools may attract the most highly trained and experienced faculty (i.e., those with cutting edge
technology skills) whose teaching practices aspire to higher levels of learning (e.g., synthesis,
analytics; Bloom, Englehart, Furst, Hill, & Krathwohl, 1956). Either way, ICT access does not guarantee success (Koch, Heo, & Kush, 2012).

Although teachers and students in high socioeconomic areas may have access to ICT in their schools, the benefits of ICT outlined earlier may not be realized. ICT may not be integrated effectively in teaching and learning activities, and in some cases, despite its availability, it may not be used at all. Cooley and Johnston (2001) highlighted two challenges for the lack of ICT integration. First, teachers do not receive sufficient onsite training and, when training exists (e.g., through professional development activities) it tends to be too focused on the operation of the ICT (hardware and software) and not focused enough on how to integrate ICT in a meaningful pedagogical way (Ertmer & Ottenbreit-Leftwich, 2010). Second, Cooley and Johnston reported that experienced teachers often resisted integrating ICT in their teaching and learning activities because they were concerned that such integration could impede or interrupt student learning. Instead, these teachers chose to rely on time-tested and proven lesson plans, not wanting to risk changing the perceived success of this learning environment with ICT. Thus, to achieve the benefits associated with ICT, it is necessary to ensure that teachers are introduce to, and convinced of, the benefits of integrating ICT in pedagogically meaningful ways. Perhaps when teachers accept the utility of ICT in teaching and learning they will form a vision about how ICT can improve their teaching experience and the impact of their efforts on student learning.

A final key challenge to realizing the benefits of effective ICT integration is to effectively prepare preservice teachers to integrate ICT in teaching and learning. If course instructors in teacher education programs are able to model effective integration of ICT, preservice teachers may then be able to develop and demonstrate a vision for effective use of ICT in their own classrooms (Ertmer, 1999). This proposition is reinforced by Lortie’s (1975) concept of the
apprenticeship of observation, which, simply put, stresses that teachers will teach in a manner similar to that used when they were students. However, the literature lacks a clear and comprehensive model of how to effectively prepare preservice teachers to integrate ICT in teaching and learning (Kay, 2006; Zipke, 2018). The current research aims to help address this major gap in the ICT literature.

In the preceding section, I reviewed literature on some of the critical challenges to the effective use of ICT in schools. In particular, I highlighted the access problem associated with schools in low socioeconomic areas, the resistance to using ICT because of a lack of knowledge in and confidence in its pedagogical usefulness, and the lack of a defining model to be used in teacher education programs to prepare preservice teachers to integrate ICT in teaching and learning. In the following section, I draw attention to three theoretical frameworks that might be particularly useful in better understanding and addressing the challenges identified above.

Theoretical Insights to Integrating ICT in Teaching and Learning

A review of the relevant literatures suggests that three theoretical frameworks are particularly relevant to integrating ICT in teaching and learning effectively, namely, Ertmer’s (1999) model of first and second order barriers to ICT integration, Technological, Pedagogical, and Content Knowledge framework (e.g., TK, PK, CK, TPK, TCK, PCK, and TPACK) (Mishra & Koehler, 2006), and SAMR (Puentedura, 2006, 2009). Each of these theories offers insight into opportunities and overcome challenges as to how to prepare preservice teachers to integrate ICT in teaching and learning.

Ertmer’s First and Second Order Barriers

Many of the factors that contribute to ineffective integration of ICT noted previously are common within teacher education programs. Ertmer (1999) suggested that barriers to integration
of ICT primarily fall into two categories: first- and second-order barriers. Ertmer’s strategy to achieve effective ICT integration speaks to both in-service and preservice teachers and respective administrators at the school level and within preservice teacher education programs. For the purposes of this study, I focused my review of the literature on first and second-order barriers on the context of preservice teacher education programs.

First-order barriers include factors external to the user. Such factors include access to technology (including both hardware and software), ongoing maintenance to ensure proper function of technology, support to develop knowledge to use the technology (e.g., training and development), technical support to aid in use of the technology (e.g., IT help desk), administrative support to allow for sufficient time to prepare ICT-integrated lesson plans, and financial support to cover costs of the technology, training, and supports. Such barriers are primarily institutionally based and teachers have very little control in overcoming them, possibly accounting for findings that teachers perceive these as the most significant obstacles for integration ICT (e.g., Hutchison & Reinking, 2011). However, effective ICT integration is not guaranteed even when first-order barriers are overcome, because second-order barriers may exist. Second-order barriers are factors internal to the individual, over which the institution has very little control. Such factors include personal assumptions and values of teaching and technology, readiness to develop the requisite technological knowledge, and the willingness to develop one’s own vision for ICT integration (e.g., take risks to change teaching style, class management, and classroom routines to integrate ICT in meaningful ways).

Some first-order barriers can be easily identified--you either have a working computer available to you or you do not. Within the context of US public schools, Ertmer (2005) reported that first-order barriers such as physical access are essentially no longer a concern with an
overwhelming majority of students and teachers having reasonable access to computers and access to the internet in schools (MDR, 2002). This statistic is comparable to the context of Canadian public and private schools. Plante and Beattie (2004) conducted a study on behalf of the Federal Minister of Industry in partnership with Statistics Canada to survey public schools on the availability of ICT. They reported, “During the 2003/04 school year, virtually all elementary and secondary schools were connected to the internet. Only a small proportion of principals reported not having computers (less than 1%) or Internet connections (less than 3%)” (p.16). These statistics demonstrate that first-order barriers, that is, the lack of access of ICT (e.g., computers in schools, access to the Internet) have ostensibly been overcome. Ertmer and others continue to investigate why ICT is not being effectively integrated in the classroom (Ertmer & Ottenbreit-Leftwich, 2010; Buabeng-Andoh, 2012; Tondeur et al., 2016) giving cause for research studies such as mine. First-order barriers may appear to have been overcome on a macro level but on a micro level, ICT may be in disrepair and unusable or become obsolete and left in the corner collecting dust. Accordingly, some first-order barriers may be more difficult to recognize. For example, the ICT may be working adequately one day and then malfunction the next. Unless the ICT-problem is reported to an IT-support centre for repair, first-order barriers might remain. This may be a macro-level problem for organizations as it may appear that first-order barriers have been overcome by providing access to ICT but on the micro level teachers and/or students may experience ongoing problems with the ICT to the extent that the ICT is not usable. In this way, first-order barriers can be understood to be an ongoing challenge to ensure that ICT is maintained in working order and that access to the ICT is consistently available.

Second-order barriers cannot always be seen. Unlike some first-order barriers that are external to, and out of the control of, the individual, second-order barriers are internal to the user
and relate to perceptions, values, and attitudes toward ICT (Ertmer, 1999). Within the context of preservice teachers, it is difficult for some individuals to be truly aware of their own personal assumptions and values about teaching and technology, and to be aware of their readiness to develop the requisite technological knowledge and the willingness to develop their own vision for ICT integration (e.g., take risks to change their teaching style, class management, and classroom routines to integrate ICT in meaningful ways). For example, feelings of anxiety using a new software program or learning an unfamiliar process on a computer may cause a barrier in using the technology to the extent that it is not used at all. Further, as alluded to in the previous section, teachers’ concerns about how the integration of ICT may alter traditional classroom routines can also serve as a barrier. For instance, despite the demonstrated benefits of the flipped classroom model, many teachers resist implementing this model because they struggle with accepting its usefulness and relinquishing power to students to direct their own learning. In the ‘flipped classroom’ model students are expected to independently engage in foundational learning activities outside of class time (e.g., complete readings, watch videos) so that class time can be spent on higher-order learning activities (e.g., application activities). The teacher no longer holds the role of expert; instead, the teacher serves as a facilitator who works closely with students providing them with individualized attention (Unruh, Peters, & Willis, 2016). Thus, teachers’ pre-existing beliefs about how learning is accomplished and who decides the learning content can serve as a barrier to effective ICT integration.

Such personal assumptions and values are often established prior to enrolling in a preservice teacher education program. Lortie (1975) purports that students subconsciously learn how to become teachers through direct experience and observation of their own teachers--essentially a 12-year apprenticeship as students continue on to graduate from secondary school.
known as The Apprenticeship of Observation. As a result, Lortie suggests that preservice teachers already have formed personal assumptions, values, and definitions of what it means to be teacher and how to teach, and such assumptions can act as a barrier to integrating and using novel ICT. Koch and colleagues (2012) found that preservice teachers are not always necessarily going to integrate ICT in their teaching just because they can use the ICT personally. Indeed, Lortie’s (1975) Apprenticeship of Observation is second-order barrier that is a challenge to overcome. If left unattended, preservice teachers may continue to teach as their own teachers taught them. Overcoming this type of second-order barrier would require significant introspection, critical self-reflection, and introduction of research-based teaching methodology to support and/or correct preservice teachers’ development of their personal assumptions and values of what it means to be a teacher and how to develop a teaching style consistent with effectively integrating ICT in teaching and learning in their own classroom.

A preservice teacher’s readiness to develop the requisite technological knowledge is also primarily considered a second-order barrier. However, there are also external factors to encourage such readiness and plan for and deliver a curriculum to develop such technological knowledge. The development of technological knowledge is better understood using the TPACK framework, discussed below. However, willingness to learn and acquisition of technological knowledge may not be enough to translate to effective integration of ICT in teaching and learning. The SAMR model (also discussed below) underscores that not all technological knowledge equates to effective integration.

Efficacy is another second-order barrier identified by Ertmer (1999). Indeed, the literature demonstrates empirical studies to support that the preservice teachers with strong self-efficacy in teaching (i.e., pedagogical knowledge) and using computers (i.e., technological
knowledge) are more likely to integrate ICT in teaching and learning (Sang et al., 2010). The second-order barriers related to the development of self-efficacy for teaching strategies and computer knowledge are closely related to the TPACK theory (discussed below), which aims to develop both technological knowledge (understanding how and self-confidence to use computers and other ICTs) and pedagogical knowledge (understanding how and self-confidence to use teaching strategies to integrate ICT in teaching and learning).

**Technological, Pedagogical, and Content Knowledge**

The TPACK framework is an extension of Shulman's (1986) Pedagogical and Content Knowledge (PCK) framework (Mishra & Koehler, 2006). Shulman introduced the PCK framework as a way of defining professional teacher knowledge and differentiating such knowledge as having three distinct knowledge domains; Pedagogical Knowledge (PK), Content Knowledge (CK), and Pedagogical Content Knowledge (PCK). Effective teachers taught from a place of integrating both pedagogy and curriculum content knowledge. For example, an effective math teacher teaches based on her specialist knowledge of the discipline (content) as well as appropriate strategies to teach math (pedagogy).

Shulman’s primary argument is that it is not enough for a teacher to master the content knowledge of a certain subject and be expected to be a good teacher. In the same way, it is not enough for a teacher to be a master of teaching strategies (i.e., pedagogy) and be expected to teach any subject. Rather, Shulman’s PCK framework purports that an effective teacher is one who has the requisite knowledge of both PK and CK and integrates them in such a way that PCK is developed and applied in the classroom, resulting in effective teaching. For example, PCK theory would support the idea that it is not enough to be an effective math teacher simply based on the fact that the teacher has a Ph.D. in math. While such a teacher may have personally
mastered the subject matter content in the math curriculum (i.e., CK), they may not have the PK to know effective teaching strategies to teach math. In a similar vein, teachers who have become master teachers with respect to teaching strategies may not be effective teach math if they have not sufficiently developed knowledge of math concepts for which they are teaching.

Rather, the teacher who has developed both PK and CK and integrate such knowledge will likely be more effective at teaching math as compared to the other two teachers who are specialized in either PK or Figure 3 illustrates Shulman’s PCK theory in a Venn diagram format noting three separate knowledge domains of PK, CK, and the intersection of PK and CK resulting in PCK.

![Figure 3](image)

*Figure 3. Depiction of Shulman’s (1987) PCK framework.*

Mishra and Koehler (2006) introduced the TPACK framework in reconsideration of Shulman’s PCK framework. Mishra and Koehler added technological knowledge (TK) as a third distinct knowledge domain noting that “The advent of digital technology has dramatically changed routines and practices in most arenas of human work” (p. 1017). However, despite the advent of digital technology in society, there was a gap between the availability of such digital
technology and its effective integration in teaching and learning in the classroom, consistent with the literature discussed above. They purported that technology (more specifically, educational technologies) require teachers to acquire requisite technological knowledge (TK) to teach effectively. Thus, the TPACK framework extended Shulman’s three distinct knowledge domains (PK, CK, and PCK) to seven knowledge domains (TK, PK, CK, Technological Pedagogical Knowledge (TPK), PCK, Technological Content Knowledge (TCK), and Technological Pedagogical and Content Knowledge (TPACK). Figure 4 illustrates Mishra’s and Koehler’s revised Venn diagram to include the seven knowledge domains.

![Figure 4. Revised Venn diagram including the seven knowledge domains.](image)

Looking outside the Venn diagram and within the dotted circle of Figure 4, the term Contexts exists to support the application of the TPACK framework to various situations. For example, Mishra and Koehler (2006) note the importance of applying TPACK in authentic
learning experiences as being beneficial for both students and teacher (p. 1045). For example, a kindergarten teacher has a significantly different context planning a lesson that integrates high technology (e.g., laptops, tablets, digital cameras) as some kindergarten students are still learning how to operate such technology. I taught kindergarten in a computer lab and students spent half of our class time in the lab entering their user name and password on the school network; they were still learning how to use the keyboard and mouse. In contrast, I taught third grade where students were able to independently take digital pictures, choose appropriate software to organize photos and narrate their own videos. For the purposes of this study, the context of applying TPACK is situated within a Bachelor of Education program to prepare preservice teachers to integrate ICT in teaching and learning and remains constant throughout. Therefore, no further discussion about the context or application of TPACK is discussed further.

Finally, the development of TPACK is not a panacea in and of itself to prepare preservice teachers to integrate ICT in teaching and learning (Brantley-Dias & Ertmer, 2013). Archambault and Barnett (2010) concluded that a failing of the TPACK framework was that it is limited in its ability to assist researchers in predicting outcomes or revealing new knowledge. Mishra and Koehler (2006) purport that the utility of TPACK framework is focused on TPACK as a descriptive framework, one that frames the development of various knowledge domains. However, the development of TPACK does not necessarily transfer to effective integration of ICT in the classroom (Brantley-Dias & Ertmer, 2013). Even if a teacher develops sufficient TPACK and integrates various ICTs in teaching and learning activities, the use of such ICTs may not be used effectively or in such a way to transform the learning experience for students. A review of more recent literature suggests some concern about the quality and utility of TPACK to integrate ICT in teaching and learning (e.g., the type of ICT used, how and why the ICT is
used, and in what capacity to enrich the learning experience). Such studies considered the SAMR framework as a way to assess and classify how TPACK was used in teaching and learning activities, relative to traditional models of teaching with no/low technology/ICT tools (Hilton, 2016; Kihoza, Zlotnikova, Bada, & Kalegele, 2016; Kimmons & Hall, 2018).

**Substitution, Augmentation, Modification, Redefinition (SAMR)**

Puentejoba (2006, 2009) introduced the SAMR framework as a means of assessing the use of various ICTs within four distinct categories: substitution, augmentation, modification, and redefinition. Further, the SAMR framework divides the four categories into two distinct uses of ICT: enhancement and transformation. Figure 5 illustrates Puentedura’s SAMR model. Although it may appear to be hierarchical in nature, it is not. Rather, the model simply reflects the four distinct categories of substitution, augmentation, modification, and transformation that are relevant to the integration of ICT. Puentejoba does not advise that there should be an evolution from substitution to redefinition. Although this may occur in some cases, a move toward transformation is not always necessary or relevant.

Consider an example to help distinguish the four SAMR categories. When I taught a lesson in letter writing in Grade 3 I used traditional teaching strategies involving low-technology (i.e., paper and pencil). The first four students that finished their letter were invited to type out their letter using word processing software on the classroom computer. In this way, the use of ICT (e.g., word processing software) merely substituted the use of teaching methods utilizing low technology (i.e., paper and pencil). The use of ICT to substitute no/low technology teaching methods is neither good nor bad. Rather, it classifies the use of the ICT to assess how the ICT is being integrated in teaching and learning activities. A classroom teacher using ICT to substitute traditional methods may be applying their TPACK in a pedagogical way to develop
technological knowledge, which can be further developed in order to integrate ICT in teaching and learning in transformational ways. For example, a lesson to teach elementary students that word processing software and type a letter substitutes using paper and pencil can be extended to integrate cloud-based, social media ICTs (e.g., Email, Google Drive, Facebook) to augment or even modify the learning process of writing letters.

![SAMR model](https://creativecommons.org/licenses/by-nc-sa/3.0/)

*Figure 5. SAMR model. © 2006 Puentendura. CC BY-NC-SA 3.0*

SAMR is a relatively new framework to the field. Despite its popularity in professional teaching practice, it has received limited empirical attention. The current study examines the validity of the SAMR model as framework for understanding how ICT is integrated in teaching and learning by course instructors and preservice teachers in the teacher education program as well as during preservice teachers’ practica. Therefore, this study addresses a current gap in the
literature. In Chapter 5, I comment on the practical and theoretical implications of the findings that relate to the SAMR framework and suggest avenues for future research.

The theoretical constructs of Ertmer’s (1999) First and Second Order Barriers, Mishra and Khoeler’s (2006) TPACK framework, and Puentedura’s (2006, 2009) SAMR model suggest that there are a number of broad categories of supporting factors to effectively integrate ICT in teaching and learning. The following section reviews the extant supporting factors found to prepare preservice teachers to integrate ICT in teaching and learning.

Supporting Factors in Preparing Preservice Teachers to Integrate ICT

A challenging goal for a teacher education program is to prepare preservice teachers to become lifelong learners of subject matter content and effective teaching strategies over their professional teaching careers (Häkkinen, Järvelä, Mäkitalo-Siegl, Ahonen, Näykki, & Valtonen, 2016; Hammerness, Darling-Hammond, Bransford, Berliner, Cochran-Smith, McDonald, & Zeichner, 2005; Koch et al., 2012). This challenge for teacher education programs is coupled with preparing preservice teachers to become lifelong learners in using and integrating ICT in the classroom (Lee, Smith, & Bos, 2014). Considering the dynamic and rapid pace of change of ICT in schools in the past 30 years (e.g., prevalence of the Internet, laptops, tablet computers and smartphones, and cloud computing), this is no easy feat (Finger, Romeo, Lloyd, Heck, Sweeney, Albion, & Jamieson-Proctor, 2015). Though there may be a clear goal for teacher education programs to prepare preservice teachers to integrate ICT in teaching and learning, there is a gap in the literature with respect to overcoming the challenges and identifying the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning.

A model for preparing preservice teachers to accomplish the aforementioned goals is needed to build on the best practices in teacher education through empirical studies. However,
the literature within the field of ICT integration and teacher education suggests that teacher education programs have not yet identified or implemented an effective model to prepare preservice teachers to integrate ICT in teaching and learning (Drummond & Sweeney 2017; Kay, 2006). A review of the literature suggests three prominent themes of supporting factors in teacher education programs aiming to prepare preservice teachers to integrate ICT: standardized technology, blended learning course designs, and the integration of the ICT throughout the teacher education program. Standardized technology includes the consistent application of various ICTs including hardware (e.g., computers, digital microscopes) and software (e.g., learning management systems, educational software). Blended learning course designs contain elements of traditional face-to-face classroom instruction in addition to teaching and learning activities that take place online through a learning management system or other web-based application, such as media streaming or a social media site (e.g., Facebook) (Alammary, Sheard, & Carbone, 2014). Evidence of the integration of ICT throughout the teacher education program can be found within all courses including instruction, meaningful learning activities, and course assignments. The inclusion of all three themes supports a foundation for teacher education programs to prepare preservice teachers to integrate ICT in the classroom. Building on existing theoretical models (e.g., Ertmer, 1999), the current study aims to support and extend these key themes by exploring supporting factors in effectively preparing preservice teachers to integrate ICT in teaching and learning.

**Standardized Technology**

Standardized technology plays a critical role in preparing preservice teachers to integrate ICT in teaching and learning (Laherto & Laherto, 2018; Lim et al., 2015). Standardized technology takes the form of hardware and software that is distributed and/or accessible to all
Faculty and preservice teachers to deliver and experience the curriculum. Whereas traditional teacher education programs rely on print-based resources (e.g., textbooks, worksheets, printed journal articles) as the primary instruments to facilitate teaching and learning, some contemporary faculties of education are replacing print-based resources with standardized hardware and software.

In past, standardized technology in teacher education programs was evident with a mandatory, laptop-based program delivery model. Some empirical studies demonstrated that there was evidence supporting the use of a laptop-based teacher education program in effectively preparing preservice teachers to integrate ICT in teaching and learning (Kariuki & Knaack, 2003; Pollara & Kee-Broussard, 2011). However, the mandatory laptop curriculum delivery model seems to have been replaced with a contemporary bring your own device (BYOD) program delivery model (Hughes, Liu, & Lim, 2016). Garba, Armarego, Murray and Kenworthy (2015) highlighted some theoretical benefits of a BYOD model implying that such benefits may be effective at overcoming first and second order barriers, develop TPACK, and leading to innovative use of ICT consistent with the SAMR framework. An empirical study investigating the use of BYODs in a teacher education program revealed that most common devices used by preservice teachers were laptops, tablets, and smartphones (Newhouse, Cooper, & Pagram, 2015). In this particular study, it was noted that preservice teachers’ hardware was far from standardized as preservice teachers brought their own devices including from Mac and Windows-based laptops, Mac and Android-based tablets, and other various ICTs including audio recorders, digital cameras, e-readers. However, it was noted that standardized hardware was primarily facilitated by the University in the form of Internet access (both Wi-Fi and Local Area Networks) to access cloud-based, standardized software (e.g., learning management systems,
websites, email). Further, the results of the study recommended that a university facilitate a laptop/tablet loaner program for preservice teachers to borrow a hardware device for those preservice teachers who are not able to bring their own device or if their device is not functioning while at school.

Standardized software is also a critical component in establishing a stable infrastructure that allows Faculty members to plan for and deliver an ICT-based teacher education curriculum. Standardized software includes access to a standard set of software for all Faculty and preservice teachers. There is a gap in the research with respect to the effectiveness of integrating standardized software in a teacher education program. The rationale for including it within the context of this study is based on reported trends of ICT in education and logic to support the claim for standardized hardware.

The Horizon Report (Johnson, Levine, Smith, & Smythe, 2009) noted that cloud computing would be an emerging technology that will have a significant impact in the delivery of public school education in the coming years. Cloud computing software programs are applications that are accessed by the user online with few requirements to download applications, and usually at no cost, regardless of the hardware. For example, preservice teachers can access a university’s LMS, email, and other websites using nonstandard hardware (i.e., laptop, tablet, or smartphone) as the software is standardized to accommodate the range of ICT devices (Kim, Rueckert, Kim, & Seo, 2013; Lennon, 2012). The use of cloud computing is a growing trend that should be considered a critical element of standardized software that supports the BYOD program delivery model. There is a gap in the literature focusing on the use of cloud computing in teacher education programs. However, the research supports the growing trend (and inevitable
use) of cloud computing in higher education (Greenhow, Robelia, & Hughes, 2009; Laherto & Laherto, 2018; Wasim, Sharma, Khan, & Siddiqui, 2014).

**Blended Learning Course Designs**

Blended learning offers preservice teachers the opportunity to experience ICT firsthand rather than simply observe their instructor model it in a classroom setting. For the purposes of this study, a blended model of instruction includes learning activities that take place face-to-face in a traditional classroom setting as well as learning activities that take place online such as collaborating in an online community (Garrison & Vaughan, 2008). The literature suggests that blended learning offers a number of benefits to students in higher education such as more interaction with classmates (Thompson, Knavel, & Ross, 2008) and higher pass rates compared to traditional multimedia learning (Wentao, Jinyu, & Zhonggen, 2016). Further, a meta-analysis by Baran (2014) suggests that the literature integrating mobile devices as a form of blended learning in teacher education programs resulted in primarily favourable results. To obtain those benefits instructors are challenged to integrate ICT in a very deliberate way (Harris & Hofer, 2009; Koch et al., 2012). The strategic use of social learning through online communities and online discussion boards situate preservice teachers’ learning of the course content nested within ICT as a pedagogical tool resulting in an organic development of teacher professional knowledge to integrate ICT in teaching and learning. Preservice teachers are learning how to facilitate learning online through their participation as a student within the online community and online discussion boards (Lim et al., 2015).

If teacher education programs aim to prepare preservice teachers for the profession, one should also consider how teachers will continue to deepen their knowledge and skills in the field. Online learning communities are used for this purpose in both formal and informal professional
settings. The Facebook group, “Ontario teachers - resources and idea sharing” is an example of an informal online learning community. The group had over 27,800 members in 2018 with daily contributions ranging from inquiries about professional knowledge, to teacher education and career questions, and to pedagogy and curriculum lesson planning the discourse and interactions are nested within the context of an online community.

Discussion boards can also be an effective means of facilitating meaningful learning. Discussion boards are accessed online through a learning management system or an online learning community, and facilitate interactions between students and the instructor. A primary benefit of discussion boards is that they are asynchronous, accessible beyond the conclusion of class. Preservice teachers have perceived discussion boards as an “important tool for sharing ideas, experiences, and perspectives in ways that facilitated a social construction of knowledge” (Ajayi, 2009, p. 97). A study by Zhang and Martinovic (2008) found similar results in that the use of discussion boards in a preservice teacher education program was preferred by preservice teachers as a way of sharing reflections from classroom readings and practicum experiences in order to free up more time for hands-on activities in face-to-face classes. Further, the use of discussion boards within a preservice teacher program not only enriches preservice teachers’ learning but may also prepare them to integrate discussion boards in their own classroom.

Considering that the use of discussion boards in learning is evident with students in early primary school (Scardamalia & Bereiter, 2006) through to secondary school (Chong Min & Wing Sum, 2008), preservice teachers should be prepared to utilize discussion boards as a tool to facilitate meaningful interactions at all grade levels (Ward, 2011). Hirumi (2002) notes that such interactions primarily take place in the form of learner-learner or learner-instructor in order to “analyze and interpret data, solve problems, and share information, opinions, and insights” (p.
Just as with any other teaching strategy, preservice teachers must learn how to facilitate meaningful and relevant learning experiences through these interactions. Lectures and classroom activities still have their place in laptop-based teacher education program. It is assumed that the goals of a teacher education program are rooted in the context of preparing preservice teachers to integrate ICT in the classroom. Certainly, elementary and secondary public school teachers would teach within a traditional face-to-face classroom environment. To remain authentic to the classroom teaching environment, it seems imperative that Faculty members plan for and design preservice learning activities that integrate ICT in both online and face-to-face environments.

**ICT Integration in Teacher Education Programs**

ICT should be used effectively and be appropriately modeled by Faculty throughout the curriculum (Tezci, 2011). Teacher education programs need to ensure that Faculty instructors are integrating ICT in each curriculum course by way of classroom teaching practices and designing ICT-based learning activities within a holistic context for preparing preservice teachers to integrate ICT in teaching and learning.

The importance of Faculty use of ICT cannot be understated. It is critical that Faculty are committed to the integration of ICT throughout the delivery of their course (D’Agostino et al., 2016). It has been acknowledged for some time that post-secondary students place high expectations on professors to integrate ICT in higher education (Wilen-Daugenti & McKee, 2008; Wurst, Smarkola, & Gaffney, 2008). Preservice teachers in particular expect that they will develop the requisite knowledge and skills to integrate ICT in the classroom (Toledo, 2005, Shelton et al., 2017). Since a growing number of preservice teachers have ‘grown up digital’ it might seem likely that they would instinctively integrate ICT into their teaching and learning.
However, the personal use of ICT does not necessarily translate to the effective integration of ICT in the classroom (Birch & Irvine, 2009; Blackley & Walker, 2017; Koch et al., 2012).

Faculty members who effectively model ICT within their courses can cast a vision for strategic ICT integration and develop preservice teachers’ self-efficacy (Ertmer, 1999). Self-efficacy plays an important role in the development of TPACK. Borrowing from the field of social cognition, Zimmerman, Bandura, and Martinez-Pons (1992) note “perceived efficacy to achieve motivates academic attainment” (p. 674). As instructors model the effective integration of ICT, preservice teachers’ self-efficacy can be expected to rise, which in turn increases their motivation to develop the requisite knowledge and skills to integrate ICT in the classroom.

Developing preservice teachers’ self-efficacy in learning about and integrating ICT in teaching and learning activities will have direct impact on the transferability of such knowledge to the classroom (Hatlevik, 2017; Sang, Valcke, Braak, & Tondeur, 2010). A study by Sahin, Akturk, and Schmidt (2009) “clearly shows that focusing on developing knowledge in technology, pedagogy, and content together in teacher education programs will likely increase teacher candidates' self-efficacy in their jobs” (p. 299). A main pedagogical objective in Faculty use of ICT, therefore, is to develop preservice teachers’ self-efficacy to the extent that they believe they can be successful in integrating ICT in the classroom. Faculty members in designing ICT-based learning activities using a holistic approach can accomplish this task.

Preservice teachers benefit from relevant learning activities that incorporate ICT in a meaningful way. However, it is not enough for course instructors to deliver lectures alongside a PowerPoint presentation and believe they are effectively integrating ICT (Kosslyn, Kievit, Russell, & Shephard, 2012; Matinovic & Zhang, 2012; McVay, Snyder, & Graetz, 2005). For teaching to be effective, instructors must integrate ICT-based learning activities that focus on
student use of ICT as a tool to facilitate learning in a meaningful and pedagogically sound way (Schmaltz & Enstrom, 2014). Preservice teachers need to be taught how to discern the appropriate use of ICT-based learning activities that effectively utilize the ICT available to them and are relevant to the curriculum (Schmaltz & Enstrom, 2014). Finally, preservice teachers need to learn to integrate ICT beyond the focus of specific ICTs. That is, preservice teachers who complete their B.Ed. program and work in a school with their own classroom will still need to learn how to effectively integrate ICT in teaching and learning as new and emerging ICTs are developed and adopted. For the preservice teacher, this implies that such learning continues well-beyond their time in a preservice teacher education program.

The effective integration of ICT in a preservice teacher education program should evolve in a natural way. Unfortunately, some preservice teachers may lack such a vision for ICT since they may have not experienced the effective use of ICT in their schooling experience (Ertmer and Ottenbrite-Leftwhich, 2010; Koch et al., 2012). Often, it is tempting for Faculty and preservice teachers to use technology for technology’s sake (Meggiolaro, 2018; Suchoff, 2006). However, forcing the use of ICT in teaching and learning will not result in meaningful learning experiences. The theoretical model I present in this work suggests themes of standardized technology, blended learning courses design, and ICT integration throughout the curriculum may be part of the supporting factors in how one teacher education program prepares preservice teachers to integrate ICT in teaching and learning.

Conclusion

This above literature review suggests that integrating ICT in teaching and learning can offer benefits to students by enriching teaching and learning opportunities. Further, it suggests that teacher education programs may have an obligation to prepare preservice teachers to
integrate ICT in teaching and learning on the basis that such knowledge, skills, and abilities are part of the demands of the teaching profession. In this chapter, I identified and discussed a gap in the literature with regard to how best to prepare preservice teachers to effectively integrate ICT in teaching in learning. As noted in the literature, there is a discrepancy between theory and practice with regard to the effective use of ICT in classrooms (e.g., Martono & Salam, 2017). I critically reviewed the literature and determined that no single theoretical model accounts for how to best prepare preservice teachers. Indeed, research has recognized a need for cross-fertilization of theoretical models related to ICT integration (e.g., Chai, Koh, & Tsai, 2013).

My review suggests that the intersection of three models (First and Second Order Barriers, TPACK, and SAMR) may be particularly helpful in developing a comprehensive curriculum response to identifying the supporting factors to prepare preservice teachers to effectively integrate ICT in teaching and learning. Thus, I seek to help bridge the gap between theory and practice. The synthesis of these models suggests that such supporting factors span the planned, enacted, and experienced curriculum, and occur dynamically in a systematic way. For example, Ertmer’s (1999) first and second order barriers provide a lens to understand the supporting factors that the B.Ed. program used to overcome various challenges to preparing preservice teachers to integrate ICT in teaching and learning, affecting the planned, enacted, and experienced curriculum. The TPACK framework focuses on the development of various knowledge domains (e.g., TK, PK, TPK) that support the development of related knowledge to overcome some of Ertmer’s second-order barriers (e.g., self-efficacy in teaching strategies --PK and developing ICT-related knowledge and skills --TK). Finally, the SAMR framework may be a useful means to discuss and assess the appropriateness of preservice teacher’s application of TPACK in practice.
CHAPTER 3: RESEARCH METHODS

In this chapter, I reiterate the purpose of this case study, situating the research questions within the context of “curriculum” as defined in Chapter 1 and Chapter 2. I describe the research site, participants and recruitment, data collection methods, and the broad analytic approach, which were based on common qualitative analytic strategies.

Study Overview

As noted in Chapter 1, the purpose of this study is to identify supporting factors that prepare preservice teachers to effectively integrate ICT into their classroom teaching. Specifically, this study seeks to understand the supporting factors within the curriculum based on the perspectives of three participant groups: course instructors, preservice teachers, and university administrators. These three perspectives are critical to informing a comprehensive understanding of the curriculum as intended by the university and program administrators, as enacted by the course instructors, and as experienced by the preservice teachers.

I aligned my understanding of the entire curriculum of the B.Ed. program as having three dimensions: the intended curriculum, the enacted curriculum, and the experienced curriculum. The intended curriculum reflects the perspectives of the university/program administrators with regard to the learning and experience goals of the program which manifest in course formats, policies, practices, student recruitment norms, etc. The enacted curriculum refers to the course work that is prepared and delivered by course instructors. More specifically, it includes course-specific activities that relate to the development of the syllabus, selection of readings, planning and delivery of teaching and learning activities both inside and outside of the classroom, as well as course assessments and assignments within the course. Finally, the experienced curriculum refers to what preservice teachers learned to integrate ICT in teaching and learning, and how they
came to learn how to do so. Based on these three curriculum dimensions, the following broad research questions guided the study:

1. *Intended Curriculum:* What steps does the University take to prepare preservice teachers to integrate ICT in teaching and learning?

2. *Enacted Curriculum:* How do course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning?

3. *Experienced Curriculum:*
   
a. How do preservice teachers learn how to integrate ICT in teaching and learning?
   
b. To what extent do preservice teachers develop and apply technological and pedagogical knowledge to integrate ICT within their practicum?

Examination of the intended curriculum seeks to develop an understanding of the technological infrastructure at the university level as a whole, as well as the pedagogical infrastructure at the program level. More specifically, this research question seeks to understand the intentions of the institution (i.e., understood via university and program administrators) and make sense of the supporting factors that are believed will prepare preservice teachers to integrate ICT in teaching and learning.

The enacted curriculum focused on course instructors; how they design course materials and experiences, consistent with the planned curriculum discussed above. Therefore, exploration of the enacted curriculum will help to understand these varying perspectives (those of university and program administrators, course instructors, preservice teachers, and through direct observation and document analysis) on the actual coursework that is delivered and experienced by the preservice teachers.
Examination of the experienced curriculum includes two areas of focus. The first seeks to understand how preservice teachers learn to integrate ICT in teaching and learning within their program experiences (e.g., the learning activities do they participate in class, the extent to which ICT is utilized to support learning). The second area of focus seeks to understand the extent to which preservice teachers are able to apply their knowledge within their practicum (i.e., hands-on teaching experience in an elementary school classroom). More specifically, this area of focus explores the preservice teacher-led elementary classroom learning activities that demonstrate their technological and pedagogical knowledge. Such information can be gained directly from interviews with preservice teachers to understand their perspectives as well as interviews from their Faculty advisors and field practicum coordinator.

It would be ideal to learn that planned, enacted, and experienced curriculum were consistently realized throughout the entire curriculum from the planning of the university and program administrators to the experience of the preservice teachers. However, this did not materialize, nor was there an expectation that this would be found. Consistencies and differences were expected between the planned, enacted, and experienced curriculum, which are noted in Chapter 4. However, I identified four supporting factors, Strategic Curriculum, Standardized Technology, Blended Learning, and Integrated Learning, that emerged from my analysis to answer the three research questions and help understand how the B.Ed. program prepares preservice teachers to integrate ICT in teaching and learning.

To be clear, my intent was not to do a program evaluation of the B.Ed. program, nor to specifically focus on explicitly measuring course instructors’ and preservice teachers’ TPACK, a measure of use of ICT by course instructors or preservice teachers as per the SAMR framework, or an identification of Ertmer’s (1999) first and second-order barriers. Rather, the focus of my
study was to identify the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning. The TPACK lens is used to make sense of such supporting factors, recognizing that the B.Ed. program was specifically looking to prepare preservice teachers to integrate ICT in teaching and learning activities. Further, the TPACK framework offers utility in understanding how the University and the Faculty of Education overcame first and second order barriers to the development of ICT knowledge and how to utilize such knowledge to effectively integrate ICT in teaching and learning. Essentially, TPACK is one piece of the puzzle in support of Ertmer’s theory of First and Second Order Barriers to technology integration and the SAMR framework.

Given the mixed findings in the literature regarding supporting factors to prepare preservice teachers to integrate ICT in teaching and learning, a qualitative methodology was an appropriate choice for this research because it allows the researcher to identify rich details of a poorly understood phenomenon (e.g., Merriam, 2009). Further, consistent with (Yin, 2018), a qualitative case study is the most appropriate methodological approach because it is not possible to disentangle the key factors from their context. That is, it is not possible to develop an in depth understanding of the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning outside of studying such factors within a successful Bachelor of Education program. Therefore, based on the above, it was appropriate to conduct a qualitative case study. As such, data were collected within a single university B.Ed. program from relevant stakeholders including university and program administrators, course instructors, and preservice teachers. In addition, to ensure the collection of rich data and to enable triangulation of findings, data were also collected from existing documents and from my personal observations of class meetings.
Participants and Procedure

Given the broad research questions, it was important to choose a research site where there was a strong commitment to prepare preservice teachers to integrate ICT in teaching and learning. As such, I reviewed the websites of a wide range of Bachelor of Education programs at Canadian Universities and consulted my network to identify potential universities, and then sought the approval of Faculty Deans. Ultimately, case study participants were recruited from the Faculty of Education at a large Canadian university that demonstrated a clear commitment to preparing preservice teachers to integrate ICT in teaching and learning with a mandatory laptop program delivery model. This ensured some level of consistency with regard to the experienced barriers to learning (Ertmer, 1999).

I recruited 16 participants for this study including three course instructors, five preservice teachers, and eight university administrators. The three course instructors and five preservice teachers were recruited from the primary/junior cohort of the B.Ed. program (i.e., preparation for teaching in elementary school, Grades K-6). The eight university administrators were recruited from across the B.Ed. program and included some Faculty who provided support to primary/junior cohort and others who provided support to the intermediate/senior cohort (i.e., Grades 7-12). Given the limited sample size within each participant group, specific demographic details will be withheld to preserve participant anonymity.

All participants were recruited by email. Beginning with the university administrators, I initially intended to interview only three within a single term. Upon entering the field and receiving suggestions from participants, I learned that additional critical information could be obtained from speaking with additional university administrators, including program administrators. As such, ultimately a total of eight university administrators (including program
administrators) were interviewed. The university and program administrator participants included a senior academic administrator at the University, the Dean, Associate Dean, two Assistant Professors, an adjunct course instructor, a librarian, and the practicum coordinator. The Assistant Professors and Adjunct course instructor were not current course instructors of the preservice teachers. Their contributions to this study were limited to providing insight and understanding of areas of the curriculum that they had an administrative influence with respect to the development of required courses that meet the overall needs of the B.Ed. program.

The initial recruitment of course instructors and preservice teachers was based primarily on timetable logistics. It was critical that this study incorporate interviews with course instructors who taught core primary/junior (elementary school level) curriculum subjects. Further, to obtain paired course instructors-preservice teachers it was necessary that these instructors also taught the preservice teachers being interviewed for this study. For example, I had to ensure that the preservice teachers participating in this study were from a class cohort that was receiving instruction from a course instructor participating in this study. This selection strategy facilitated efficient access not only to course instructors but also preservice teachers for interviews as well as classroom observations. With the assistance of the Dean and the Associate Dean of the Faculty of Education, I identified two primary/junior cohorts that suited the timetable logistics and three primary/junior core curriculum instructors. Three course instructors were invited to participate in the study and all three responded positively to the email invitation. Based on the advice of the Dean of Faculty of Education at the research site, I asked course instructors to suggest names of preservice teachers who may be willing to participate. Using this strategy, I approached seven students across two cohorts with a personal email invitation to participate and five of agreed to participate.
The research design intended on recruiting preservice teachers from one cohort of students that had classes from the three Primary/Junior core curriculum course instructors. Spanning the recruitment of preservice teachers across two cohorts resulted in an unintended benefit. While all three course instructors taught both cohorts, one course instructor taught two separate courses to two cohorts. This provided the opportunity to enhance the diversity of contexts in the study by allowing exploration of four primary/junior core curriculum courses (Mathematics, Science and Technology, Social Studies, and Language Arts) with only three course instructors.

In Chapter 4, I present the results of the study through direct quotes and by sharing stories of the research participants. I attribute the quotes and stories to each research participant and their corresponding interview and page number to demonstrate that the results include contributions from all of the research participants. Research participants are identified and acknowledged according their participant group. Quotes and stories are attributed to a specific interview and page number. University administrators are identified with the abbreviation UA and a number (1 through 8). UAs only had one interview and therefore do not require a number to the associated interview transcript. For example, UA3 identifies the third university administrator interviewed. Course instructors and preservice teachers had multiple interviews. As a result, I assigned a number to identify which interview transcript the content came from. For example, CI3-3, pg. 5 refers to page 5 of the third interview with course instructor 3.

**Data Collection Methods**

Semi-structured interviews, existing documents, and classroom observations generated rich data for analysis and discussion. A description of the data collection methods follows,
organized by participant group: university administrators, course instructors, and preservice teachers.

**Interviews**

Based on Merriam (2009), interviews followed a semi-structured format (see Appendices 8-10 for interview guides for each participant group), ensuring that participants in each group were reasonably asked the same questions at the start of the interviews. I further probed for clarification and understanding without the assistance of an interview guide to allow flexibility for participants to tell their own story and discuss matters important to them. The face-to-face interviews typically lasted one hour and were conducted individually (with the exception of a joint interview with the Dean and Associate Dean) and in private settings. All interviews were recorded, with the permission of the participants, using an Edirol R-09HR audio recorder and I wrote out field notes as a backup to the audio recording.

Interviews were transcribed using a transcription protocol (Merriam, 2001). I personally transcribed all of the course instructor interviews (approximately 10 hours’ worth). The remaining interviews were transcribed by three research assistants (RAs). RA1 transcribed the preservice teacher interviews (approximately 17 hours) and RA2 and RA3 transcribed the program and university administrator interviews. All research assistants had research/transcription training and experience and signed a confidentiality agreement. As a check on RA accuracy, I reviewed each transcript while listening to the audio recording and made minor corrections to spelling and formatting as per the interview protocol. Given their unique perspectives, interview guides were developed for each participant group (see Appendices 8-10).

Each of the three course instructors participated in a series of three interviews over the term. The first interview took place shortly after the start of the term. I sought to capture the
background of instructors, their experiences with teaching and ICT, and the steps they took in preparing to teach their course. The questions were fairly broad and primarily open-ended (e.g., “Tell me about what steps you took to prepare for your course”). This type of non-leading questioning allowed course instructors to self-identify activities they took part in when preparing their courses. Based on their responses, I probed with clarification questions such as, “and what does that involve?” At times, I refocused participants to address an area that they did not mention. For instance, I asked of one course instructor, “To what extent did you research and incorporate new academic readings and/or textbooks for this course?” Such questions were asked when shared/known information indicated appropriateness (e.g., the course syllabus identified a reading list, textbook, etc., implying the course instructor might have participated in reviewing and/or developing the list of required readings).

Subsequent course instructor interviews took place after observing each instructor teach a class. In this way, I would be better prepared to ask specific questions about the teaching strategies employed and the learning activities that preservice teachers participated in. Three preservice teachers participated in up to four semi-structured interviews. The initial interview took place at the start of the term and documented their background, expectations, and interests in the Bachelor of Education program. The second interview took place later in the term following my classroom observation and the preservice teachers’ initial practicum. The third interview took place during the preservice teachers’ final practicum. Two preservice teachers participated in a fourth interview to describe the processes they used to gain access to the learning management system, and gather electronic documents and course materials (assignments, outlines, etc.). The fourth interview took place immediately following completion of the term. Later interview questions emerged from classroom observations and ongoing
interviews and experiences. In total, study participation required approximately seven hours of a preservice teacher’s time.

Eight university and program administrators were interviewed to understand the related policies and practices that affect instructor development, ICT infrastructure, and development of the teacher education program (preservice teacher practicum, curriculum development, philosophy, etc.). Initially, I sought out to interview the current and past Dean of the Faculty of Education program as well as a senior administrator at the University that worked outside of the Faculty. During my initial interviews with course instructors and preservice teachers, I was referred to contact several other people that had knowledge of the practicum, curriculum development, and unique perspectives of preparing preservice teachers to integrate ICT in teaching and learning. Ultimately, seven interviews were completed (six individual interviews and one joint interview with the Dean and Associate Dean).

**Existing Documents**

The data collected included written documents (e.g., course outlines, assignments, and evaluations) and electronic documents downloaded from the University’s website, preservice teachers’ lesson plans, and digital presentations that preservice teachers used for their classes and practicum. These data were used to inform the semi-structured interviews, ask probing questions, and to deepen my understanding of the participants’ stories. The documents collected and analyzed also corroborated the explicit reports from participants and confirmed inferences I made during my time on campus (e.g., doing classroom observations, participant interviews).

**Personal Observations**

I conducted two classroom observation sessions for each of the four subject matter courses. All students were aware that I would be present and that I was there taking field notes of
my personal observations of the course instructors’ teaching (i.e., the enacted curriculum). No recordings, video, or audio were made during classroom observations.

My field notes were used to inform subsequent interviews with classroom instructors and preservice teachers to ask about specific teaching and learning activities. My analysis of the course instructors’ teaching and the preservice teachers’ learning highlighted some similarities and differences between the enacted curriculum (as taught by the course instructor) and the experienced curriculum (what preservice teachers actually learned in the course). Some of similarities and difference were specific to a particular teaching and learning activity. For example, I observed a Science and Technology class that included a hands-on science experiment with traditional thermometers, followed by the introduction of digital thermometers and how they might be of use in the classroom.

The perceptions of the preservice teachers’ learning (i.e., experienced curriculum) were both similar and different to that of the course instructor’s perceptions of the teaching activity (i.e., the enacted curriculum). Finally, the classroom observations deepened my understanding of the similarities and differences between the planned curriculum and the enacted curriculum. For example, I learned that the University installed interactive whiteboards in every class to facilitate the use of digital presentations by course instructors (and preservice teachers) in the classroom. However, in one particular class I observed that the interactive whiteboard was not in use. I learned from the course instructor that this particular whiteboard was not operational, and had been for some time.

Overall, such observations brought to light how, in some cases, the planned, enacted, and experienced curriculum were consistent in theory and in practice to prepare preservice teachers to effectively integrate ICT in teaching and learning. Paradoxically, in some cases, there was a
disconnect between the planned and enacted curriculum but not between the planned and experienced curriculum. In other words, the planned curriculum that was determined by the University and/or the Faculty of Education were not particularly enacted by a course instructor or took place during the preservice teachers’ practica. Regardless of this disconnect between the planned and enacted curriculum, preservice teachers still experienced significant learning to integrate ICT in teaching and learning consistent with the initial planned curriculum. The examples are described further in Chapter 4.

**Analytic Approach**

Recall that the purpose of this research was to identify the supporting factors that prepare elementary preservice teacher candidates to integrate ICT in teaching and learning, relevant to the three dimensions of curriculum (planned, enacted, and experienced) reflecting the university/administrator, instructor, and preservice teacher perspectives, respectively. To uncover the supporting factors, I began by immersing myself in the data, listening to audio recordings and reviewing transcripts, documents, and my field notes to generate themes. There was an overwhelming amount of data collected from these sources including transcripts of over 50 hours of interviews, hundreds of pages of documents from the University’s website, the academic calendar, course syllabi, preservice teacher’s lesson plans, and over 15 hours’ worth of field notes from classroom observations and time spent around the B.Ed. campus. Indeed, I had an ocean of data to organize, categorize, and make sense of. I initially struggled with making sense of the data and after exhausting myself swimming in this ocean of data, I needed to come back to shore and ground the data into usable chunks for analysis. As a result, I developed a two-stage approach that a) pulled out data that was evident in three or more data sources including any of the three research participant groups, my personal observations and field notes, and existing
documents, and b) was related to answering one or more of the research questions. My goal was to reduce the data into a manageable database of the results that included all sources (Yin, 2018).

I had some preconceived notions of what I might discover in the data based on my review of the literature in designing this study, my professional experience as an elementary classroom teacher, and my experience completing a B.Ed. and a M.Ed. in Educational Technology. In particular, I looked for references to Standardized Technology, Blended Learning, and evidence of ICT integration, all important contributors to preparing preservice teachers to effectively integrate ICT in teaching and learning. Then, remaining data were explored openly to identify relevant themes. As noted above, a code was applied when a term or concept was found across three of the five sources (i.e., any combination of university administrators, course instructors, preservice teachers, observations and field notes, and documents) and when it was relevant to one or more of the research questions (i.e., intended, enacted, or experienced curriculum).

The process of identifying and categorizing the data based on various perspectives was initially overwhelming and time-consuming. My approach was the following: First, from the raw data I generated a lengthy list of potentially relevant topics and concepts on poster-sized chart paper. Based on this open-coding, I then studied the raw data looking for patterns to emerge. I used various coding strategies with a focus on reducing the raw data into common terms and categories within each participant group. Once common themes were identified across participant groups, I then I reanalyzed the raw data (e.g., transcripts, field notes, documents) again to test and confirm that the themes were valid factors and supported with sufficient subfactors. For a theme to be retained as a ‘supporting factor’ it had to satisfy two criteria: First, the theme had to be evident in three or more data sources (administrators, course instructors, preservice teachers, existing documents, personal observations). Second, it had to be related to
answering one or more of the research questions. Although this strategy may have resulted in excluding potentially informative information specific to one or two data sources, I believed that this strategy would be most successful in identifying the most critical common supporting factors. In the following chapter, I present the resulting factors and subfactors from these analyses.
CHAPTER 4: RESULTS

The primary purpose of this research was to identify the supporting factors that prepare elementary preservice teacher candidates to integrate ICT in teaching and learning. I aimed to identify the supporting factors from three perspectives: the intended, enacted, and experienced curriculum. As noted in Chapter 3, the analytic approach entailed identifying themes within and across the three participant groups, existing documents, and personal observations. Below I first offer an overview of the type of data generated by each of the data sources and a description of how the data contributed to answering the research questions. Following this, I present the emergent supporting factors and subfactors from the data, as told by the participants of the study, my personal observations, and as revealed in the documents collected.

Overview of Data Collected

I collected data from a number of sources including research participants, various documents, and through personal observations during my four months on campus. As discussed earlier, research participants included university administrators, course instructors, and preservice teachers. I noted personal observations in my field notes while on campus (e.g., the physical resources available, the layout of classrooms on campus, and observing classes taught by course instructors participating in the study). Various documents collected as data for the study included the University’s Academic Calendar, B.Ed. program documentation found in print (e.g., brochures, course syllabi, handbooks) and on the University’s website (e.g., Faculty and instructor profiles, B.Ed. program information, course schedules). Further details of the data collected from these sources are discussed below.
University Administrator Interviews

Interviews with the university (and the Faculty of Education’s administrator) administrator (UA) participant group were helpful in answering all of the research questions. However, the data collected from this participant group were particularly helpful in responding to Research Question 1: *What steps does the University take to prepare preservice teachers to integrate ICT in teaching and learning?* Indeed, several steps were taken to accomplish this goal, which are discussed at length in this chapter. The University’s actions were successful as evidenced by one university administrator who talked about the success of the B.Ed. program in preparing preservice teachers to integrate ICT in teaching and learning: “...our very high rate of placement of preservice teachers is a result of their acquisition of technology skills for learning that they acquire here because of the integration of technology into all aspects of their [teacher education] program” (UA6, p. 14).

Additional responses from university administrators focused on steps that were taken at both a university level and at a program level (i.e., the Faculty of Education). For example, at the university level there was significant investment of time and money to establish a standardized technology infrastructure to deliver an ICT-rich learning environment for all students at the University (UA1, p. 6; UA3, p. 26; UA8, p. 17). At the time of the data collection, a mandatory laptop program delivery model was being used. However, I learned that the University had, and continued to have, ongoing discussions about the next direction of standardized technology. One university administrator commented about the future direction of laptops and standardized technology asking rhetorically:
Are we going to continue to fight for one standardized platform, or a multiplatform—are we even going to stay in the business of supplying and providing standardized laptops to Faculty and students? Those are the discussions that will occur overtime. (UA7, p. 18)

Regardless of the possible change in direction of the use of standardized technology for program delivery, she continued to talk about the importance of the University’s commitment to technology integration across the university:

...the fact that our past presidents and our current administration have unanimously agreed that technology is not only an important piece of the university experience but it’s probably, in this institution, the piece apart from human resources that we need to pay the most attention to... (UA7, p. 19)

Another example of a step taken at the Faculty of Education was the purposeful design of the B.Ed. curriculum including the required courses (and sequence in which they are taught) and other learning experiences (teaching practicum, math and science days, etc.) over the academic year (e.g., UA2, p. 2; UA5, p. 5). Math and science days were single focused learning experiences that took place on one day, supplementing the math and science courses in the curriculum. One university administrator commented about the importance of the need for math and science days for the primary/junior preservice teachers to develop competence in math and science in this way:

There is a need [for preservice teachers] because most of the preservice teachers who are in the primary/junior program do not have a background at all in math or science. There is a need to at least build in some additional comfort with concepts. They essentially need more experience with all the concepts that are involved in both math and science...it’s a
content experience that they actually need to have more facility, with more comfort, and so that’s why the Math and Science Days were particularly vital. (UA5, p. 5)

Further details about the steps that the University and the Faculty of Education took are discussed later in this chapter.

The university administrator participant group also helped to provide supplementary responses to Research Question #2: *How do course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning?* The perspectives of the course instructors certainly provided the primary data to respond to this question. However, there were some comments made by the university administrators that echoed the course instructors’ comments (e.g., UA3, p. 14; UA5, p. 13), strengthening the validity and trustworthiness of the results. For example, in discussing the importance of the integration of ICT across the curriculum, one university administrator shared how she coordinated the integration of ICT taught and learned in the dedicated ICT course with assignments from subject matter courses taught during that same term. She continued to explain:

I try to do some course integration with other [course instructors] so one of the first things I asked the Language Arts [course instructors] is what they’d like [the preservice teachers] to do. So, they might ask, ‘We want them to do this digital narrative for Language Arts early on in the year so can you please give [the preservice teachers] a tool that will enable them to do this?’…so we taught [the preservice teachers] how to create a photo story…it’s plain, simple, easy, and you can do it a half an hour and have something really practical to work with. Then you can take that same concept and apply it in a whole different area. So, it originally started with Language Arts. (UA3, p. 14)
She continued on indicating that ICT tools and skills were specifically taught to preservice teachers based on the input from the course instructors of other subject matter courses, including Science and Technology and Teaching Methods.

Finally, the university administrator participant group also contributed to answering Research Question #3: (a) *How do preservice teachers learn how to integrate ICT in teaching and learning?* and (b) *To what extent do preservice teachers develop and apply technological and pedagogical knowledge to integrate ICT within their practicum?* Even though the perspectives of the preservice teachers collected during multiple interviews over the term were primarily relied on in answering these research questions, the university administrators’ comments confirmed and echoed many of the preservice teachers’ comments (e.g., UA2, p. 3; UA4, p. 7). For example, one university administrator commented on the limitations that preservice teachers commonly experience when trying to integrate ICT into their teaching during their practicum at different schools and school boards. She stated:

...the reality is, in terms of what the [preservice teacher] is able to do will be very much dependent on the host teacher and the host board. There are some boards where [preservice teachers] have greater success in being able to do what they can do as a result of what [ICT] the board has. Some boards don’t even like Smart Boards, for example, or if they do have a Smart Board, and I have heard from many [preservice teachers], the technology is hidden away in a closet... (UA4, p. 7)

Indeed, this university administrator echoed the mixed results that the preservice teachers reported during their practicum. Further details about Research Question #3 are provided later.


Course Instructor Interviews

Course instructors were in an ideal position to respond to Research Question #2: *How do course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning?* All of the course instructors participating in the study gave a number of examples of how they planned for and delivered their courses in support of the University’s intention to prepare preservice teachers to integrate ICT in teaching and learning (e.g., CI1-2, p. 8; CI2-2, p. 6; CI3-1, p. 4.). The course instructors all gave examples of how they focused first on teaching the subject matter content of their course to ensure that preservice teachers had significant subject matter content knowledge. For example, I learned from the course instructor (CI3-2, p. 3) who taught the elementary math course in the B.Ed. program that an overwhelming majority of preservice teachers lacked basic math skills and were actually afraid to teach math. She went on to explain that there is significant research to support this claim and discussed the importance of actually teaching math concepts to preservice teachers before teaching them the specific pedagogical strategies to teach math. The math course instructor shared:

I ask the question, ‘How many of you are deathly afraid to teach mathematics?’, and we’re just talking primary/junior preservice teachers here, 80% of the hands go up and this is in a room of 300. There is that stigma about teaching math. (CI3-2, p. 3)

As a result, this course instructor planned her course and the Math Day to ensure that the math syllabus completely covered the provincial mathematics curriculum documents to ensure that preservice teachers had significant content knowledge in math before learning the pedagogical strategies to teach math, including integrating ICT in meaningful ways (CI3-2, p. 7).
Course instructors also contributed to answering Research Question #1 *What steps does the University take to prepare preservice teachers to integrate ICT in teaching and learning?* For example, all of the course instructors mentioned to some extent their obligation to integrate ICT in their teaching (e.g., CI1-2, p. 9; CI3-1, p. 12). One course instructor (CI3) indicated that the integration of ICT in teaching was even raised in her job interview. Admittedly, she had little to no practical knowledge of educational ICTs that could be integrated in classroom learning as she was a retired principal and had not taught in the classroom for several years. However, she supported the purchase and integration of emerging ICTs, such as a set of portable interactive whiteboards, to be used in her classes (CI3-1, p. 12). She expressed her willingness to learn how to use various ICTs and explained the implicit obligation to integrate ICT in teaching and learning at the University, “At [the University] you really should use the technology that is there because it is there and the [preservice teachers] can use it so why shouldn’t you?” (CI2-2, p. 9).

Thus, the course instructors helped to shed light on university initiatives to prepare preservice teachers to integrate ICT in teaching and learning, namely by ensuring that new hires were aware of the explicit expectations to integrate ICT in their teaching and the implicit expectations to use ICT because of the pervasive presence of standardized technology at the University.

Finally, course instructors also contributed to answering Research Question #3a: *How do preservice teachers learn how to integrate ICT in teaching and learning?* and #3b: *To what extent do preservice teachers develop and apply technological and pedagogical knowledge to integrate ICT within their practicum?* The course instructors often shared stories about how preservice teachers learned to integrate ICT in teaching through the preservice teachers’ learning experiences through their academic coursework and practicum (e.g. CI1-1, p. 6; CI3-3, p. 9). For
example, one instructor shared her observations that preservice teachers often learn from each other during in-class presentations and micro-teaching sessions (CI2-1, pp. 17, 18).

She continued on stating that it seemed like there was new and emerging technology coming out every day, creating a challenge for course instructors to know all about it. Her response to overcoming that challenge was to encourage and challenge the preservice teachers in her course to integrate new and emerging ICTs, summarizing that, “...so far the [preservice teachers] are learning from each other, which is how I setup my classroom--that it is okay to learn from each other” (CI2-1, p. 17). This quote echoed comments made by some of the preservice teachers (e.g., PT1-3, pp. 14-15; PT2-3, p. 21; PT4-2, pp. 4-5) about how often they learn to integrate ICT in teaching and learning from their peers through micro-teaching sessions and working on group assignments. In this way, the course instructors validated the preservice teachers’ experience and increased the trustworthiness of the data collected.

**Preservice Teacher Interviews**

The responses from preservice teachers directly related to Research Question #3a: *How do preservice teachers learn how to integrate ICT in teaching and learning?* and Research Question #3b: *To what extent do preservice teachers develop and apply technological and pedagogical knowledge to integrate ICT within their practicum?* One preservice teacher spoke of her initial reaction to the first few weeks of the dedicated ICT course and learning about the assignments in the course:

[The course instructor] said to the class, ‘You’re gonna create a website, you’re gonna create a digital photo story, you’re gonna use Camtasia [screen recording and editing software], you’re gonna use Audacity [audio recording and editing software]’ ...and I’m thinking there’s no way--like how am I gonna do all this stuff? (PT5-1, p. 12)
The ICT Course is one of many references talked about by all participant groups. However, hearing the stories of the preservice teachers who shared their excitement and trepidation in preparing for their next practicum, their accomplishments and frustrations completing their practicum, and their other experiences in the B.Ed. program (e.g., PT2-1, p. 2; PT4-3, pp. 1-5; PT5-1, p. 2) were a great help in identifying the supporting factors that I later present.

The preservice teachers also contributed to answering Research Question #1: What steps does the University take to prepare preservice teachers to integrate ICT in teaching and learning? It is doubtful that the preservice teachers had direct knowledge of, or were conscious of, the actual steps taken by the University to prepare preservice teachers to integrate ICT. However, the preservice teachers talked about terms and concepts that were similar to the planned actions of the University and the Faculty of Education. For example, consistent with comments made by one university administrator (UA2, p. 6) one preservice teacher noted,

It’s great where we get to share each other’s ideas so when I go to a placement I know where to go [onto the LMS] to see where people have already done their kindergarten placements. And I can go into this folder, in this class, and there will be an area where people have posted kindergarten resources or lesson ideas, or unit plans... obviously some will be better than others. Some will be more detailed than others. But it’s nice that we have that setup – that’s maybe the best thing that’s come out of [the LMS] – that at the end of the B.Ed. program we are all going to have access to everyone’s shared ideas and resources, which is great. (PT1-1, p. 17)

This comment reinforces the University’s intentions with regard to using ICT to support the preservice teachers’ practicum. In fact, the preservice teachers’ experiences often mirrored the intentions of the University and the Faculty of Education with respect to a strategic curriculum
that included a dedicated ICT and teaching methods course, subject matter courses, and a practicum (e.g., PT2-2, pp. 15-16; PT3-2, p. 13).

Research Question #2 asked, *How do course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning?* Although the preservice teachers were not able to speak to how course instructors planned to prepare preservice teachers to integrate ICT in teaching and learning, they were in a good position to comment on what they experienced in their courses. The perspectives from the preservice teachers usually verified (but sometimes contradicted) the perspectives of the course instructors. For example, one course instructor mentioned different types of standardized website bookmarks and software that were preloaded on the mandatory laptops (CI3, p. 19). Such ICTs were mentioned frequently among the preservice teachers (e.g., PT1-1, p. 21; PT2-1, p. 18; PT3-2, p. 13; PT4-3, p. 2; PT5-2, p. 2). For instance, one preservice teacher commented on the extent of resources and websites that were preloaded onto her laptop “The resources in Physical Education – there’s a ton—so resources are huge. For Math we also have quite a few websites that are useful. Social Studies, in our last class we did a WebQuest” (PT2-2, p. 25).

**Personal Observations as Recorded in Field Notes**

My personal observations of classes and being on campus contributed to my understanding of the data, often validating the stories of the participant groups. For example, one day while on campus I noticed the science classroom at the Faculty of Education that did not have an interactive whiteboard installed (FN2, p. 21). I found this odd because every other classroom that I had visited had one installed. This was also mentioned in an interview with a course instructor who expressed frustration about it. This Science & Technology course
instructor (CI1) indicated that her classroom did not have an interactive whiteboard; she had a place on the wall for it to go, but the place was empty.

In another example, I observed a Social Studies class. The course instructor (CI2) was in the middle of her lesson, facilitating a learning activity and having preservice teachers create a mind map after completing an online research activity. At this point, Internet connectivity went down campus-wide. No Internet access for the CI2 or the preservice teachers in the middle of a lesson. CI2 modified the learning activity for preservice teachers to create mind maps on their laptop (e.g., MS. Word, MS. Power Point, drawing software) so access to the Internet was not specifically required. She closed off the class at the end explaining what they would have done to continue the lesson had access to the Internet been available. Further, she commented depending too much on ICT in lesson planning to work in all cases and to have a back-up plan for situations like that day in class. Finally, she ended the class a bit early and had students continue the learning activity online, where she would post the links to the final learning activity on the LMS (FN3, p. 30). As such, observations of classroom teaching and the learning environment helped to connect the dots so to speak between what the course instructors and preservice teachers talked about in their courses with respect to their learning in those classrooms. Thus, comments from my field notes helped to provide credence and trustworthiness to the data.

Documents

Some light was shed on the supporting factors by various documents that I collected in relation to the University, the B.Ed. Program, and the courses. I refrain from quoting from these data sources specifically in an effort to protect participant and university anonymity (i.e., quotes of the data could be searched for on the Internet, thus revealing the identity of the University). As such, I paraphrase relevant content from existing documents.
Much of the content from documents was used prior to the participant interviews as a means of establishing foundational knowledge of the program and informing the participant interview questions and probes. Although this information sometimes offered credence to descriptions from participants, much of the documents collected from the University’s website were often mundane or purely written for marketing purposes. For example, I reviewed the academic calendar for the University to obtain a list of the curriculum courses and their descriptions (D1, p. 66). This information was useful in confirming the courses for the B.Ed. program and the related academic terms in which they were offered. In contrast, course syllabi and lesson plans and course instructors were much more helpful in seeing how preservice teachers and course instructors planned to integrate ICT in their teaching and learning activities (e.g., D4, pp. 1-11; D15, pp. 1-10). For example, the syllabus for Social Studies listed the course outcomes, including preservice teachers’ demonstrated content knowledge of the prescribed provincial Social Studies curriculum, appropriate pedagogical teaching strategies to teach literacy, and ability to integrate various ICTs in class and via assignments (D6, pp. 2-3).

**Emergent Factors and Subfactors**

As noted in Chapter 2, my review of the existing literature suggested that three factors would be particularly important to preparing preservice teachers to integrate ICT in teaching and learning: standardized technology, blended learning course designs, and the integration of the ICT throughout the teacher education program. As noted in Chapter 3, for a particular theme to be retained during analysis it must have been noted by three of the five data sources (three participant groups, existing documents, personal observations) and related to at least one of the three research questions. As suggested above, the results of my analysis indicated support for standardized technology and blended learning. However, the integration of ICT appeared to be
more complex than originally conceived. The results of my analysis indicated that strategic curriculum and integrated learning were also highly relevant themes in supporting preservice teachers to integrate ICT in teaching and learning. Thus, four primary themes emerged from the analyses, each with several subthemes. Based on the content of these themes, I labelled the major themes as Strategic Curriculum, Standardized Technology, Blended Learning, and Integrated Learning. Here I provide a brief description of each of these factors and corresponding subfactors (See Table 2 for an overview). Following these definitions, I present evidence of the supporting factors and subfactors specifically in relation to each of the research questions.
Table 2

**Overview of Results**

<table>
<thead>
<tr>
<th>Supporting Factor</th>
<th>Intended Curriculum</th>
<th>Enacted Curriculum</th>
<th>Experienced Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strategic Curriculum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT Course</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Teaching Methods Course</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Subject Matter Courses</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Math and Science Days</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Standardized Technology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandatory Laptops</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Interactive Whiteboards &amp; Digital Projectors</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Software &amp; Websites</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>3. Blended Learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LMS</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>In-class &amp; Online Learning</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Integrated Learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICT and Pedagogy integrated in subject matter courses</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Practicum where preservice teachers plan and teach with ICT in a meaningful way</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
In the current context, *Strategic Curriculum* includes substantive learning to develop knowledge, skills, and abilities related to becoming a successful elementary classroom teacher by taking specific courses in the B.Ed. program, and the timing and sequence of courses. Indeed, the literature has long recognized that courses in a teacher education program must be structured in a way that promotes understanding with regard to how ICT intersects with content and pedagogy (e.g., Lim et al., 2015; Shulman, 1987). The specific courses in the B.Ed. program included, among others, an ICT course, a teaching methods course, subject matter courses, and the Math and Science Days. The timing and sequence of these particular courses also impacted how preservice teachers learned to integrate ICT in teaching and learning.

Collectively, these two elements reflect a strategic curriculum. More specifically to this study, preservice teachers concurrently learned how to use various ICTs, developed an understanding of effective teaching methods, and mastered subject-matter content (more specifically in math and science). I present examples of the Strategic Curriculum subfactors and the importance of the sequential timing as evidence of the strategic curriculum in the B.Ed. program as they relate to the research questions below. Table 3 outlines the curriculum courses discussed and notes the academic terms in which they were taught.
Table 3

<table>
<thead>
<tr>
<th>Term</th>
<th>Course Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dedicated ICT Course</td>
</tr>
<tr>
<td>1</td>
<td>Dedicated Teaching Methods Course</td>
</tr>
<tr>
<td>1</td>
<td>Subject matter course: Mathematics I</td>
</tr>
<tr>
<td>1</td>
<td>Subject matter course: Science &amp; Technology I</td>
</tr>
<tr>
<td>1</td>
<td>Math Day</td>
</tr>
<tr>
<td>2</td>
<td>Subject matter course: Mathematics II</td>
</tr>
<tr>
<td>2</td>
<td>Subject matter course: Science &amp; Technology II</td>
</tr>
<tr>
<td>2</td>
<td>Science Day</td>
</tr>
</tbody>
</table>

Broadly speaking, *Standardized Technology* refers to ICTs that are available to all Faculty, course instructors, and preservice teachers for the delivery of B.Ed. courses at the University. Based on the participants’ responses and my observations, the following three subfactors emerged from the data: mandatory laptops for course instructors and preservice teachers, interactive whiteboards and digital projectors, and software and websites. These subfactors are discussed in detail with examples from participants as they relate to each research question in the section below.

In addition, I identified university ICT infrastructure as a subfactor through my personal observations. University ICT infrastructure included campus-wide Wi-Fi classroom tables with LAN ports (for Internet Access), and electrical outlets to support laptop charging (FN1, p. 15). Participants did not acknowledge or discuss examples noted in my observations in any meaningful way and was not considered further.
*Blended Learning* refers to a teaching delivery model that incorporates both online and face-to-face components to facilitate learning. In the context of this study, blended learning incorporates the use of an LMS to deliver B.Ed. courses, traditional face-to-face classroom learning activities, and online learning within and outside of the classroom. I provide specific examples of how blended learning supported these goals in responding to the research questions.

*Integrated Learning* refers to the integration of preservice teachers’ knowledge of ICT, teaching methods, and subject matter content. As discussed previously, preservice teachers took individual courses in ICT, Teaching Methods, along with their subject matter courses. The integration of the knowledge, skills, and abilities developed within each of these individual courses was gradually integrated over the academic year, culminating in the preservice teachers demonstrating full integration of their technological knowledge, pedagogical knowledge, and subject matter content knowledge. The subfactors of ICT and pedagogical integration in subject matter courses, as well as preservice teachers’ demonstrated integration of same in their practica are discussed below in relation to the research questions.

**Research Question 1: Intended Curriculum**

This research question sought to understand the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning that were initiated by the University. More specifically, my interest was in learning what elements of the B.Ed. curriculum were planned by the University and/or the Faculty of Education. The results of this study show that there were several actions taken: developing a strategic curriculum, making use of standardized technology, as well as ensuring that courses used a blended learning delivery model and an integrated learning teaching/learning model that combined technological, pedagogical, and content
knowledge. I describe each of these supporting factors and subfactors and provide examples of each drawing on participant stories and my personal observations.

**Supporting factor 1: Strategic curriculum.** The data indicated that the University and its administrators developed a strategic curriculum by having a dedicated ICT course, a Teaching Methods course, key subject matter courses, and special Math and Science Days. The B.Ed. curriculum (i.e., list of courses and its sequence) were outlined in detail in a Faculty of Education program brochure and highlighted the Faculty of Education’s commitment to prepare preservice teachers to be technologically savvy 21st-century teachers learning in an ICT rich environment at the University (D8, p. 3-5).

**ICT course.** Preservice teachers and administrators spoke at great length of the importance of the ICT course. All elementary preservice teachers were required to take the same ICT course in the first term. One university administrator commented:

> I think it makes sense to have a course specifically focused on ICT because--I mean the key thing really is the Language Arts course with technology integrated into it to demonstrate that language arts has many different facets that prompt technology and enhance the way that we learn language arts or teach language arts. Ideally, you would never have a single ICT course because ICT would be embedded in every component of what we work with the students and the Faculty on, whether it be geography or language arts or math or whatever. I think that this has been true but we also discovered, I think, a lot of them [preservice teachers] still need a course that focused just on how to use the technology (UA3, p. 11).

Another university administrator (UA5, pp. 17-18) noted that the purpose of the ICT course was two-fold. The first goal was to introduce preservice teachers to a wide-variety of web-based and
in-class ICTs (e.g., particular websites) to develop the technological knowledge in how to use such ICTs. The second goal was to gradually incorporate preservice teachers’ learning from the teaching methods course (also taught in Term 1) to teach them when to integrate use of such ICTs in a meaningful and pedagogically-sound way. These two goals were also echoed by PT2 as she shared her experience with the ICT Course (PT2-2, pp. 15-16).

**Teaching Methods course.** Also indicative of strategic design of the B.Ed. Program, the Teaching Methods course was taught in the first term. As with the ICT course, this course was a standalone, dedicated course that taught preservice teachers specific pedagogically sound teaching strategies. The University had a campus-wide focus on teaching effective pedagogical strategies and, despite the obvious emphasis on the use of ICT, a primary underlying principle for teaching and learning was the understanding that pedagogy, not ICT, is what facilitates learning (e.g., UA6, pp. 1-2). This university administrator went on to explain, “…all the technology in the world doesn’t change pedagogy. Pedagogy is about how people teach and how people learn” (UA6, pp. 1-2). This perspective had clearly trickled down to the Faculty of Education where the roots of preparing preservice teachers to integrate ICT in teaching and learning was not about ICT but, rather, effective teaching strategies. (UA2, pp. 4-5; D8, p. 1-2; D18, pp. 1-2).

The teaching strategies were taught without any particular context. For example, the teaching strategy of Think, Pair, Share was taught to preservice teachers as a way to engage all learners. First, each student thinking about their response to a question. Second, students discussed their thoughts with a peer sitting close to them. Third, the learners shared their thoughts with the whole class (UA2, p. 3). Once preservice teachers demonstrated knowledge of pedagogical strategies, they began to search out and integrate various ICTs. For example, this
university administrator explained that in the Teaching Methods course (which she also taught in the first term) preservice teachers learned about mind mapping as a teaching strategy. Once the preservice teachers learned about the principle and played around with creating mind maps (on paper or on their laptop), she explained the extension of the learning to incorporate ICT, “I was just providing different options to create assignments and that’s where [the preservice teachers] really integrated the technology” (UA2, p. 4).

She continued that she introduced and modelled Smart Ideas, a mind-mapping software, as a way to integrate technology with pedagogical teaching strategies. However, given the limited time that the preservice teachers had in the Teaching Methods course, she kept all of the learning strategies on the LMS course website for preservice teachers to reference in their subject-matter courses as well as during their practicum to help with their lesson planning. In practice, she commented that between her and the preservice teachers in the course, they collectively “modelled thirty-some odd strategies throughout the course” (UA2, p. 6).

Subject matter courses. The subject matter courses refer to the curriculum courses that preservice teachers would be expected to teach in an elementary classroom. As noted in Table 3, the subject matter courses for Mathematics, Science & Technology, and Language Arts were delivered throughout the entire academic year (i.e., in Terms 1 and 2). Additional subject matter courses included Social Sciences, The Arts, and Physical and Health Education. For this dissertation, I asked participants about their perspectives on Math I & II, Science & Technology I & II, Social Studies, and Language I & II. In addition, I observed the Mathematics II, Science & Technology II, Language Arts II, and Social Studies subject matter courses each on at least two occasions.
One university administrator spoke to the importance of hiring subject-matter experts as course instructors for the subject-matter courses as a first priority rather than hiring a course instructor with superior ICT skills. She explained further:

When you hire the [course instructors], they’re hired to teach a specific course and how tech savvy they are is less of a selection criteria...the technology skills are nice to have but maybe not as much of a selection criteria--their expertise in the [the subject matter] is front and center. (UA7, p. 10)

It was clear that the intention of the University was to hire course instructors to teach courses that they were highly experienced in subject matter content (e.g., math, science, language arts) as a top priority. This was evident in reading the course instructor bios available on the Faculty of Education website (e.g., D5, p. 1; D19, p. 1; D20, p. 1; D21, p. 1). For instance, CI1’s (an elementary Science and Technology course instructor) bio includes:

- Taught both primary/junior and intermediate/senior general science;
- Has a Bachelor of Science degree;
- Retired from teaching intermediate science from [the local school board];
- Taught at all levels from K to 12 and university;
- Also taught at the Ontario Science Centre;
- Was the Science Consultant for [the local school board];
- Was a presenter for the Scientists in Schools program; and
- Authored numerous documents in curriculum for the Youth Science Foundation, [the local school board], the Ministry of Education for [the province], Canada Wide Science Fair, Science Teachers’ Association of [the province], and Atomic Energy of Canada. (D5, p.1)
Indeed, this Faculty profile supported the university administrator’s mention of hiring course instructors based on the strength of their experience teaching the subject matter content.

**Math & Science days.** The Faculty of Education planned the teacher education curriculum to include additional opportunities to learn math and science subject matter content (e.g., UA2, p. 2; UA5, p. 5; PT4-2, p. 10; D6, p. 1). These opportunities took place separate from the formal curriculum of the teacher education program and were not found in the University’s academic calendar. These additional learning opportunities took place on a single full weekday in the first term on a day designed for professional development opportunities (i.e., no curriculum courses were scheduled on this specific day).

There were two key goals with regard to Research Question #1 and the Math and Science Days. The first purpose of the Math and Science Days was to develop preservice teachers’ personal knowledge of the subject matter content. For example, I learned from one university administrator who spoke to elementary preservice teachers’ knowledge gap in understanding basic concepts in math and science. Referring specifically to math, she said, “Most preservice teachers can’t do it, can’t teach it, let alone teach it well, with or without ICT” (UA1, p. 16). In effect, through teaching basic knowledge of the provincial math and science curriculum, the Faculty of Education intended to also address their second goal, which was to build preservice teachers’ confidence in effectively teaching the subject matter content.

In summary, the results of this study demonstrate that the B.Ed. curriculum was planned with standalone courses in ICT and teaching methods, as well as subject-matter courses and the Math and Science Days. There is evidence of a clear strategic intention to develop technological knowledge (from the ICT course), pedagogical knowledge (from the teaching methods course),
teaching subject-matter content knowledge (with an emphasis on math and science) first in isolation and then through gradual integration of these knowledge domains with each other.

**Supporting factor 2: Standardized technology.** The data indicated that standardized technology was an important way in which the University and its administrators aimed to support preservice teachers to learn how to integrate ICT in their teaching. The most commonly discussed subfactors included mandatory laptops and interactive whiteboards & digital projectors. One University document explained the extent of the need for the standardization in this way:

Our Laptop Learning program requires full compatibility of all software and hardware. All computers have the same software platform per program making it easier for students and professors to communicate [and that] the laptops must be institutionally-owned in order to use licensed software. (D10, p.1)

The compatibility issue was the primary reason given for the standardized technology that started with compatibility with the use of laptops leased from the University that branched out to compatibility with software preinstalled on the laptops (UA1, p. 6; UA8, p. 18; D11, p. 1) and with other hardware technologies such as interactive whiteboards, digital microscopes, etc., which are discussed in detail below.

**Mandatory laptops.** The University invested significant time and money in a university-wide mandatory laptop program that required all of the preservice teachers to lease a standardized laptop. All preservice teachers were provided with the same laptop while course instructors were provided with a similar laptop, though an older model (CI3-1, p. 2). However, each laptop used by course instructors and preservice teachers had the same disk image. That is, each laptop in the B.Ed. program was preloaded with the same educational and productivity
software, the same drivers for digital microscopes, digital projectors, interactive whiteboards, printers, etc. (e.g., UA4, p. 14). The purpose of the mandatory laptop program was to ensure that all preservice teachers and course instructors had the same access to educational software, network configurations, and campus-wide printers (e.g., UA8, p. 17). The University’s website stated the intention to facilitate learning through the mandatory laptop program:

Students have access to test and assignment results and may obtain lecture notes and sample spreadsheets electronically, allowing for more-focused in-class learning. Students use email, websites, online discussion groups and other chat forums to collaborate with peers, Faculty and experts in their area of study. In addition, students may visit our campus library or obtain electronic resources from anywhere on the network via their laptop. (D3, p. 1)

One university administrator (UA6, p. 4) spoke to the vision of facilitating a mandatory laptop program, stressing the University's intention for Faculty to use their mandatory laptops to deliver the B.Ed. curriculum through the LMS, to use of educational software and websites, and for integration with other ICTs (e.g., digital microscopes, interactive whiteboards). All other standardized technologies discussed depended on, to some degree, the mandatory laptops. The primary reason for the use of mandatory laptops seemed to be based on issues of compatibility with other ICTs (e.g., access to educational software, use of digital microscopes, interactive whiteboards). UA7 spoke to the macro reasons behind the issues of mandatory laptops and compatibility stating, “There is always the institutional pressures of standardization” (p. 18). These institutional pressures varied from providing technical support to Faculty and students (UA8, p. 17), compatibility with other peripherals, interactive whiteboards, student response devices, digital microscopes (UA4, pp. 7, 9), standardized software (UA3, p. 14), and
instructional support for Faculty to integrate ICT through the Teaching and Learning Centre (UA8, p. 13). Standardization ensured that all Faculty and preservice teachers had access to a digital learning environment where ICT was integrated on a daily basis and that there was available support from IT services to update software, troubleshoot malfunctioning hardware, etc. (CI1-3, p. 20).

Interactive whiteboards & digital projectors. The University installed interactive whiteboards and digital projectors in most classrooms at the Faculty of Education campus. Interactive whiteboards were growing in popularity and found commonly in elementary schools (UA4, pp. 7, 12). In fact, all participant groups spoke of their importance in the B.Ed. program (UA3, p. 23; CI3-3, pp. 14, 21; PT3-2, p. 15; PT2-2, p. 18). Digital projectors included basic digital video projection from a laptop to a screen as well as digital overhead projectors that used a digital document camera to capture a hands-on activity projected for the whole class to watch. As above, the purpose of the standardized technology for interactive whiteboards and digital projectors was to ensure that all Faculty and preservice teachers had functional access to these ICTs (on campus and during practicum) by plugging in their university-provided laptops (UA4, pp. 7, 9). In this way, the University intended to overcome compatibility issues between the laptop and other ICTs used in the B.Ed. program.

Supporting factor 3: Blended learning. Blended Learning also emerged as a critical intention of the University and its administrators. Factors that were identified by at least three data sources in relation to this research question included LMS and in-class and online learning.

LMS. The University had a campus-wide LMS for all programs. Within the content of the B.Ed. program, all of the data sources discussed the LMS being used to deliver course materials, receive preservice teachers’ assignments, facilitate online discussions, and coordinate
communications among course instructors and preservice teachers (e.g., UA3, p. 26; UA8, p. 22; CI3-2, pp. 7-8; PT1-2, p. 16; PT4-2, p. 1; D12, p. 1; FN4, pp. 48-51). In this way, the LMS was the hub of most digital interactions between course instructors and preservice teachers. However, it was noted by one university administrator (UA6) that the University expected that most, if not all, new course instructors would not have the experience of teaching or learning with an LMS (or other ICTs). She discussed the challenge of getting new course instructors teaching with an LMS in this way:

I was once told a long time ago that teachers teach the way they were taught...I actually believe that there’s probably a lot of truth to that. Therefore, when you bring in [course instructors] to teach preservice teachers in a Faculty of Education, one of the challenges you have is to break the mold of the personal experiences to really explore the new possibilities. (UA6, p. 4)

As a result, online learning experiences for course instructors were available through the LMS so that the teaching Faculty could learn how to use the LMS from the perspective of the learner to understand the challenges and opportunities of using the LMS as a course instructor. This experience was made available through the Teaching and Learning Centre (UA6, pp. 1, 2, 4).

Finally, the University created an LMS for Faculty advisors (university employed staff that check in on and supervise preservice teachers during their practicum) and associate teachers (school board classroom teachers supervising preservice teachers while on practicum). This resource was designed as a way to communicate with Faculty advisors and associate teachers and respond to issues as they arose in the field (UA4, p. 20). The online portal, as UA4 referred to it, facilitated communication to assist associate teachers in learning about the requirements of the
practicum for preservice teachers, provide access to the practicum guide book, submit
performance reports, and communicate directly with the practicum coordinator (D9, pp. 7-8).

**In-class and online learning.** The B.Ed. program made use of both in-class and online
learning activities. In-class learning activities included traditional face-to-face classroom
learning strategies such as lectures, small group discussions, and micro-teaching sessions (e.g.,
FN1, pp. 28-32; FN3, pp. 24-25). One university administrator stressed the benefits of traditional
face-to-face learning without any technology integration such as when preservice teachers
participated in a program called Tribes. This program focused on building community within
their ‘tribe’ and became one of the foundational parts of bringing preservice teachers together
(UA5, p. 2).

Online learning activities with preservice teachers included actively working outside of
class and working in small groups in class (e.g., CI3-3, pp. 3, 6, 8, 15; PT3-1, pp. 17-19; FN3,
pp. 26-27; D3, p. 1). The inclusion of online learning activities in a traditional face-to-face
classroom gave preservice teachers the opportunity to learn how to integrate ICT in teaching and
learning with the support of their course instructors and peers. For example, I asked one
university administrator about the Faculty of Education’s perspective on the mobility of ICT. She
responded, “Yep, in fact, the more mobile the better you will be because it allows for access
anytime, anywhere” (UA5, p. 24). Indeed, this mobility facilitated preservice teachers’
communication with course instructors and peers, access to resources on the LMS during
practicum, and learning resources on demand (e.g., video tutorials on specific software).

**Supporting factor 4: Integrated learning.** According to the data, there were several
prominent integrated learning experiences planned by the University and the B.Ed. program. For
example, the University clearly stated their intention to prepare preservice teachers to integrate
ICT in teaching and learning in the Academic Calendar, stating that preservice teachers would experience firsthand learning to understand how to integrate ICT effectively in their own classroom teaching (D1, p. 64). This comment was also echoed by a number of university administrators as one of the primary goals for the B.Ed. program (UA1, p. 21; UA7, pp. 19, 23; UA8, p. 6). This document depicted a curriculum whereby preservice teachers would learn how to integrate ICT by participating as a learner. That is, the course instructors taught the preservice teachers as they would teach an elementary class, modelling the integration of ICT with appropriate teaching strategies within the courses they were teaching. Such authentic learning experiences are associated with higher intentions to integrate ICT among preservice teachers (Admiraal et al., 2017; Valtonen et al., 2015).

A second example of how the University planned for preparing preservice teachers to integrate ICT in their teaching was the hiring policies of new teaching Faculty. One administrator noted the contractual requirements for new course instructors and tenure track professors to integrate ICT in their teaching (UA6, p. 3). She acknowledged that this approach to integrating ICT in teaching was still a relatively new concept for Faculty and that there were plenty of supports for new hires including a mentorship program and learning supports at the Teaching and Learning Centre to help Faculty learning how to use the LMS, how to integrate ICT in meaningful ways, etc. (UA6, p. 4). Another administrator explained that the ubiquitous presence of ICT within the Faculty of Education and throughout the university (laptops, LMS, digital projectors, etc.) placed an obvious pressure on new hires to at least have an interest in, and be willing to learn to integrate ICT in their teaching:

The fact that ICT is ubiquitous in this place, not just this Faculty but in this university, it creates that pressure and combined with the hiring practice that you know you can’t get
hired unless you have at least some affinity to the technology...because in the case of most of our sessionals being hired without [experience teaching with] technology, and understanding and so forth is less important. When you hire the sessionals they’re hired to teach a specific course and how tech savvy they are, is less of a selection criterion.

(UA7, pp. 9-10)

The hiring policies balanced the need for new course instructors who were experienced classroom teachers that were experts in subject-matter content as well as an understanding that new hires understood their obligation to integrate ICT in their teaching with the support of peer mentors and the Teaching and Learning Centre.

A third example concerned the Faculty of Education’s expectations for preservice teachers to integrate ICT and pedagogical teaching strategies during their practicum. The Practicum Handbook was clear with regard to the expectation for preservice teachers to use their standardized laptop during practicum. However, it also recognized the limitations of access to ICT in some schools. Specifically, the Practicum Handbook stated (D9, p. 3):

[The Faculty of Education] uses an all laptop learning environment and as such, all preservice teachers have their own university-leased laptop computer. The Bachelor of Education program at [X] integrates appropriate use of technology as it forms an integral part of the program. [The University] expects preservice teachers to use their laptop computer during their practica, however, [the University] recognizes the varying degrees of technology available in the schools and in the classrooms, and understands the variety of possibilities that exist for preservice teachers using their laptops. Preservice teachers should bring their laptops to [their practicum] every day and use it for note taking during class time and lesson planning. Preservice teachers are encouraged to find ways to use
[their laptop] when appropriate in consultation with their Associate Teacher. Laptops can be used for:

- Making observations;
- Preparing lessons;
- Using the Internet for resources;
- Applying Ministry of Education software specific to particular subject areas; and
- Sharing resources, presentations, and information with Associate Teachers, students, and teachers. (D9, p. 3)

In summary, the Faculty of Education was clear in its’ intention to promote preservice teachers’ use of their mandatory laptops in their practicum to the fullest extent possible, while recognizing that this intention may be limited based on the extent to which various ICTs were available and supported by the Associate Teachers at the host elementary schools.

**Research Question 2: Enacted Curriculum**

This research question sought to understand the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning that were developed and/or delivered by courses instructors. More specifically, my interest was in exploring how course instructors plan for and deliver their courses in order to prepare preservice teachers to integrate ICT in teaching and learning. The results of this study explain common activities that the course instructors engaged in to accomplish this goal, including: developing a strategic curriculum, making use of standardized technology, using a blended learning delivery model, and integrated learning teaching/learning whereby teachers modeled appropriate use of ICT integration and also required students to combined technological, pedagogical, and content knowledge in the subject matter
courses. As with the prior section, I provide examples of these supporting factors from the participants’ stories and from my observations.

**Supporting factor 1: Strategic curriculum.** Strong evidence of the use of strategic curriculum was found for how instructors planned and delivered their courses in a manner that would prepare preservice teachers to integrate ICT in teaching and learning (CI1-1, p. 21; CI2-3, p. 9; CI3-2, pp. 9-10; D15, pp. 1-10). Subfactors of strategic curriculum that relate to Research Question 2 include the ICT course, the Teaching Methods course, key subject matter courses, and the Math and Science Days.

**ICT course.** I did not observe the ICT course that occurred during the first academic term. However, it is important to note that the course instructors stressed the importance of the ICT course in developing preservice teachers’ technological knowledge in the first few weeks of the term so that knowledge could be applied across all courses such as how to use various software packages, edit digital media, make narrated presentations, use interactive whiteboards (CI1-1, p. 13; CI2-3, p. 1; CI3-1, p. 5; UA3, p. 19).

For example, one course instructor (CI1) talked about the importance of the ICT course in preparing the preservice teachers to learn how to create and edit videos, noting that she did not have the requisite skills to teach preservice teachers various technologies. More specifically, she stated, “The learning curve for me when I came here to start teaching-my limited ability in terms of technology- was at about a 90-degree angle” (CI1-1, p. 6). Considering that CI taught the elementary Science and Technology course, it was more important for CI1 to focus her attention on teaching preservice teachers how to integrate ICT in teaching science, rather than spending time teaching preservice teachers to learn how to create and edit videos and use other technologies. In this way, the ICT Course was relied on by the course instructors to teach the
preservice teachers how to use various ICTs. Then, working in collaboration with the ICT Course instructor, the course instructors planned various learning activities over the first few weeks of the term that incorporated the preservice teachers’ new skills in ICT. As an example, CI1 shared a story about the importance for preservice teachers to learn how to make narrated presentations (e.g., photo stories using PowerPoint, Prezi, or PhotoStory software) early in the first term. This would enable them to create a narrated presentation about a science field trip she took the preservice teachers in the first few weeks in the term (CI1-1, p. 16; PT1-2, p. 10). This story is reported later in the results reported for Research Question #3 with details from the perspective of the preservice teachers.

With respect to Research Question #2 and understanding how course instructors prepare and deliver their courses to prepare preservice teachers to integrate ICT in teaching and learning, it is important to understand that the course instructors (specifically CI1 in the example above) relied on the ICT Course teaching preservice teachers how to use various ICTs. Based on what they were learning, the course instructors collaborated with the ICT course instructor to plan learning activities to ensure that preservice teachers had the knowledge, skills, and abilities to integrate various ICTs in their subject-matter courses.

One university administrator’s comments supported the course instructors’ beliefs in this regard, stating:

The instructor of the ICT course has traditionally tried to cooperate and coordinate with other course instructors around issues of [speaking as the ICT course instructor to the other course instructors], ‘You know what [ICTs] I am going to show [preservice teachers], you know what software I am going to teach them, what software I am going to
leave to you to teach them so you know how much they are going to know before they get to you. (UA7, p. 14)

Indeed, the course instructors’ collaboration with the ICT Course instructor was a critical step in preparing preservice teachers to integrate ICT in their subject-matter courses.

*Teaching Methods course.* As with the ICT course discussed above, I did not observe the Teaching Methods course that occurred during the first academic term. However, I learned from all course instructors about the importance of this course (CI1-3, p. 1; CI2-2, p. 22; CI3-2, p. 6). In particular, the course instructors teaching Math, Science, and Language Arts in the first term coordinated with the Teaching Methods instructor with regard to when, in the term, particular teaching strategies would be covered such that particular pedagogical strategies were taught in the Teaching Methods course before the subject matter instructors would use them in teaching content matter. Similar to the course instructors’ reliance on the ICT course instructor teaching the preservice teachers about various ICTs discussed above, the course instructors relied on the Teaching Methods course instructor allowed the preservice teachers the time to first learn pedagogical teaching strategies from the before integrating these teaching strategies in the subject matter courses.

CI3 discussed the importance of the teaching methods course with respect to teaching specific teaching strategies including how to use clickers for student engagement (CI3-3, p. 10), using rubrics for setting expectations for assessments (CI3-1, p. 14), the importance of hands-on learning activities with manipulatives (CI3-2, p. 5), and the use of using learning centres to break up the class into smaller learning groups with the teacher acting as a facilitator (CI3-2, pp. 4, 5, 11.). I witnessed many of the teaching strategies taught in the Teaching Methods in all four subject-matter courses during my personal observations of classes (FN1, p.27-31; FN2, pp. 19-
21; FN3, pp. 13-21, 24-30). So as with the ICT course, the course instructors leveraged what was being taught in Teaching Methods course to apply those teaching strategies to the subject matter courses. This sentiment was echoed by some of the preservice teachers who commented that their course instructors made specific reference to teaching strategies that they had been taught in the Teaching Methods course (PT5-4, p. 8; PT4-2, p. 5). Indeed, the course instructors prepared their subject matter courses on pace with the pedagogical strategies that were being taught to the preservice teachers in the Teaching Methods course.

**Subject matter courses.** The subject matter course instructors took two critical steps to prepare and deliver their courses in a strategic way. First, they spoke to the importance of preservice teachers first needing a solid understanding of the subject matter content (i.e., teaching preservice teachers the substantive content of the related subject matter course to the extent that the preservice teachers had the requisite content knowledge, consistent with the provincial Ministry of Education Curriculum Documents). Second, course instructors spoke to the importance of subsequently educating preservice teachers on the pedagogical strategies to teach the subject matter content (CI1-1, p. 17; CI2-2, p. 12; CI3-2, p. 7). For example, earlier in this chapter I shared a story from the math course instructor who cited numerous journal articles that demonstrate that preservice teachers generally lack the knowledge, skills, and abilities to understand and complete elementary math concepts. To reiterate her comments, she stated:

I ask the question, ‘How many of you are deathly afraid to teach mathematics?’, and we’re just talking primary/junior preservice teachers here, 80% of the hands go up and this is in a room of 300. There is that stigma about teaching math. (CI3-2, p. 3)

Thus, course instructors began with the basic concepts of math, science, language arts, and social studies until preservice teachers demonstrated the requisite content knowledge.
The second priority was to teach preservice teachers *how to* teach the subject-matter content. Another course instructor also spoke about the importance of how to teach social studies through critical thinking teaching strategies:

My focus is to get the [preservice teachers] thinking about how to teach critical thinking (probably one of the biggest ones) and how to teach historical thinking -- not to be so bogged down on whether you know the dates and all the content stuff of history and social studies but [on] how to teach the strategies how to get there. (CI2-2, p. 12)

This example demonstrates how subject matter courses integrated pedagogical knowledge with content knowledge, a form of PCK.

**Math & Science days.** Consistent with the intentions of course instructors, the Math and Science Days appeared to transmit content knowledge as well as help preservice teachers develop their confidence in teaching these subjects effectively. Talking with the math course instructor I learned that there were a number of different classrooms that the preservice teachers would attend, each with course instructors facilitating a number of learning centres. The entire day was dedicated to preservice teachers learning the elementary math (science) curriculum in a fun and playful way--a stark contrast for most preservice teachers in how they were taught math when they went to elementary school (UA1, pp. 15-16; CI3-3, pp. 5, 7-8; PT5-2, pp. 11-12). Both the math and science course instructors appeared to sincerely enjoy their respective days, talking about how fun it was to see preservice teachers gain new content knowledge and effectively model contemporary teaching strategies for their content areas (CI1-3, p. 6; CI3-3, pp. 7-8). This was facilitated by having the preservice teachers complete the activities as they would expect a student in an elementary class to experience it. Instructors were sensitive to the needs of the preservice teachers, recognizing that there was a wide-range of knowledge, skill,
and ability in working with the subject matter content within the cohort. As a result, the instructors modelled contemporary teaching strategies in teaching the subject matter content, paying attention to and supporting those preservice teachers who did not appear to understand a concept and needed further explanation (CI3-1, pp. 7-8).

**Supporting factor 2: Standardized technology.** According to the data, instructors also planned and used standardized technology including mandatory laptops, interactive whiteboards and digital projectors, as well as software and websites to support preservice teachers to learn how to integrate ICT in teaching and learning.

*Mandatory laptops.* All of the laptops for course instructors and preservice teachers were preloaded with the same software (CI3-3, pp. 2-3; D10, p. 1; D11, p. 1). Of particular interest was that each course instructor in the B.Ed. program identified key websites that they intended to use in their class. All of these websites were preloaded as added as bookmarks/favourites to all laptops. This proved to be efficient for the course instructors with respect to directing preservice teachers to specific websites (organized in folders by course) during in-class sessions as well as providing access to resources to be used during practicum for lesson planning and classroom teaching (UA1, p.17). For example, one instructor explained:

All preservice teachers have the basic [software and websites] loaded on their laptop. For example, there’s a Primary/Junior Language Arts [folder of bookmarks], there’s a Primary/Junior Math [folder of bookmarks] that the websites are already saved there and all of the sites can be opened up. (CI3-1, p. 5)

I asked about how this idea came to be (i.e., that all preservice teachers would provide standardized websites for each course, preloaded onto the laptops). She explained that it was a decision made by the founding teaching Faculty in the B.Ed. program to have every laptop
preloaded with standardized software and bookmarks to valuable teaching websites (D13, p. 1; CI3-1, pp. 6-7; UA1, p. 8). The list of bookmarked websites is updated each year with input from all of the teaching Faculty to ensure that the software and websites are current and can be easily accessed by preservice teachers with a few clicks in class rather than having to type out each website or taking the time to download related educational software (CI3-1, p. 5).

**Interactive whiteboards and digital projectors.** For the most part, the course instructors made use of the interactive whiteboards and digital projectors in a manner consistent with the intention of the University. I observed the course instructors actively using interactive whiteboards and digital projectors and asked the course instructors about my observations. Much like the preservice teachers learning how to use new ICTs, the course instructors were also learning how to use such ICTs and to use them in a meaningful way. Two of the course instructors had not used these types of ICTs in their own teaching. They also noted that while they had access to interactive whiteboards, they were still learning how to use this technology effectively. The course instructors commented on their learning curve with such ICTs. One instructor related that her learning curve with these ICTs was more of a ‘W’ (CI1-3, p. 21). Just when she thought she had mastered something, something new came along. She further commented that she began to learn from her preservice teachers during their micro-teaching sessions (CI1-3, pp. 22-23). All course instructors were aware of available learning sessions with the University’s Teaching and Learning Centre to support Faculty. However, due to time constraints, all of the course instructors reported that they learned more how to use these ICTs from their preservice teachers during micro-teaching sessions and other presentations. It was clear that the course instructors were open to learning from their preservice teachers how to use new and emerging ICTs such as interactive whiteboards and digital projectors.
It is interesting to note one anomaly in the results for this section. One course instructor (CI1) reported that the interactive whiteboard in her classroom was not functioning. It had been reported to IT support for repair, but had not been repaired in over a term (CI1-1, p. 10; FN1, p. 15). This obviously limited her use of the interactive whiteboard and she relied more on the digital projector to share her PowerPoint presentation slides and made use of the document camera to demonstrate science experiments to the class.

**Supporting factor 3: Blended learning.** It was clear from the data that course instructors also planned to support preservice teachers’ use of ICT by developing and delivering their courses with a blended learning course delivery design and using the LMS (CI2-3, p. 9; D11, p. 3; UA5, p. 13; FN3, p. 30). Multiple sources of data collected gave examples of blended learning including in-class and online learning and examples of different ways that course instructors used the LMS to facilitate teaching and learning activities.

**In-class and online learning.** The blended learning course delivery model included both in-class and online learning components that preservice teachers were required to participate in. For example, all courses included online learning components that were completed outside of class as well as in-class learning activities. The course outline for Language Arts II (D4) taught in the second term of the B.Ed. program was a good example that demonstrated how CI2 planned her courses with a blended learning course design. The course outline contained a table that outlined the weekly topics, in-class activities, assigned independent readings to be completed prior to class, and an online activity component. Table 4 provides an example of a few weeks of the Language Arts II Course Outline (D4), paraphrased to protect the anonymity of the course instructor and the research site.
<table>
<thead>
<tr>
<th>Week</th>
<th>In-Class Activities</th>
<th>Readings</th>
<th>Online Activities</th>
</tr>
</thead>
</table>
| 2    | Long Range Planning in Language Arts  
- Important considerations  
- Matching learning with students’ developmental needs  
- Integrated Unit Planning: Assignment requirements  
- Micro-Teaching Presentations | www.readingrockets.org/article.96  
Provincial Language Arts Curriculum Document  
Pg. 33-34 | Complete the following online learning activity to prepare you to complete your Integrated Unit Plan:  
www.universitywebsite.com/unitplanning |
| 3    | Developing a Writing Program  
- Using Exemplars  
- Writing Fiction  
- Writing Non-Fiction  
- Evaluating Writing  
- Teaching Writing Conventions  
- Micro-Teaching Presentations | Journal Article on Teaching Grammar  
Journal Article on Using Descriptive Video to Teach Writing | Complete Webcast on Non-Fiction writing and post a response under the comments section.  
www.curriculum.org |
| 4    | Teaching and Evaluating Poetry  
- Writing Poetry  
- Digital Poetry  
- Assessing Poetry  
- Micro-Teaching Presentations | Journal Article on Social Justice Poetry  
Journal Article on Teaching Poetry  
Example of Digital Poetry: | Visit the link below to access and play with digital poetry fridge magnets. Develop an activity using this site for your unit plan:  
https://magneticpoetry.com/pages/play-online |
As depicted in Table 4, both in-class and online learning activities were planned, consistent with a blended learning course delivery model. This was evident in talking with course instructors (e.g., CI1-2 p. 8; CI2-3, p. 21; CI3-3, pp. 3, 5, 13) and preservice teachers (e.g., PT1-3, p. 13-15; PT3-1, pp. 17-18), as well as being consistent with my personal observations (e.g., FN4, pp. 53-58) and existing documentation (e.g., D3, p. 1; D8, p. 5).

**LMS.** There was clear evidence of planning to deliver courses in a blended learning environment, including completing online learning activities on various websites as well on the University’s LMS. However, there was a range of course instructors’ self-reported expertise in using the LMS. One course instructor discussed some of her initial challenges of using the LMS as a teaching tool, as she had never used one as a teacher or as a student. She stated:

> The first year that I started teaching it was a huge, huge learning curve for me because I knew nothing about [the LMS]. I knew nothing about how to post things, you know how to have discussions or post anything because I never dealt with an LMS my work or my career. (CI3-1, p. 2)

Essentially, the other course instructors implied that their use of the LMS was also a work in progress (e.g., CI1-2, p. 20; CI2-1, pp. 13-14). Although one course instructor had previous experience with an LMS (both as a teacher and student), she acknowledged that there was still a lot more for her to learn (CI2-1, p. 6). Course instructors acknowledged that they learned how to use the LMS from their peers, IT support services, taking workshops at the Teaching and Learning Centre, and/or just playing around and trying new things (e.g., CI1-1, pp. 6-7; CI2-3, p. 7; CI3-3, pp. 6, 12).

**Supporting factor 4: Integrated learning.** Course instructors demonstrated use of integrated learning to support preservice teachers’ integration of ICT in their teaching and
learning. The key subfactor born from the data was the integration of ICT and pedagogy in subject matter courses.

**Integration of ICT and pedagogy in subject matter courses.** There was clear evidence of course instructors integrating ICT with specific teaching strategies in the subject matter courses. For example, in my observation of a Language Arts class, one instructor (CI2) used a PowerPoint presentation (D7) to facilitate a class on teaching oral competency. Rather than lecturing to the class and using PowerPoint to support her lecture with lecture notes, she used PowerPoint to provide directions to the preservice teachers to facilitate a discussion of the assigned readings that were to be completed prior to class. Figure 6 is one of the slides that she used to facilitate small group discussion of the readings (D7, p. 3).

<table>
<thead>
<tr>
<th>Discussion of Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyone bring up their chart on their laptop</td>
</tr>
<tr>
<td>Decide on a group leader, a timer, and a summarizer</td>
</tr>
<tr>
<td>Everyone has a responsibility to participate</td>
</tr>
</tbody>
</table>

*Figure 6. Sample slide from PowerPoint presentation for a Language Arts class: Discussion.*

In this example, the use of ICT was evident in two ways. First, the readings assigned prior to class were available online through a link from the LMS. Second, PowerPoint slides were available to preservice teachers to download in advance of class so they could follow along with them when presented on the classroom interactive whiteboard and/or to access at a later date as a teaching resource (FN3, pp. 13-14).
The pedagogical strategy described by this course instructor (CI2-3, p. 18) was to provide preservice teachers with directions to complete the activity and with descriptions of the assigned roles for the group members so small groups could work independently. This freed-up the instructor’s time to observe, assess, and respond to questions in individual groups. In this way, the course instructor modelled the appropriate use of ICT to assign readings (accessible via a link on the LMS) and use PowerPoint to communicate the directions and expectations of the learning activity. The latter essentially augmented the learning experience whereby the preservice teachers could work independently without having to check-in with the instructor, allowing her to provide support to groups and learners who needed it the most. The majority of the slides that followed in the PowerPoint Presentation were consistent with the pedagogical strategy of guiding small group discussion with questions, prompts, etc. She concluded with a summary of the pedagogical value of such supports (FN3, pp. 13-21). Thus, this particular course instructor provided a full integration of ICT and pedagogy within her Language Arts class as a way of modelling how preservice teachers could use this lesson in their own classroom. Figure 7 is a slide that summarizes the importance of this learning activity (D7, p. 11).

<table>
<thead>
<tr>
<th>Teachers observe and listen carefully to make program decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence of well-developed oral skills</td>
</tr>
<tr>
<td>• Asking questions</td>
</tr>
<tr>
<td>• Telling about themselves</td>
</tr>
<tr>
<td>• Engaging in play</td>
</tr>
<tr>
<td>• Listening to and reading stories</td>
</tr>
<tr>
<td>• Interacting with teachers and other children in diverse situations</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Evidence that oral language may not be as well-developed</td>
</tr>
<tr>
<td>• Being shy or withdrawn</td>
</tr>
<tr>
<td>• Being unwilling to participate</td>
</tr>
<tr>
<td>• Appearing to be unwilling to read</td>
</tr>
<tr>
<td>• Having difficulty speaking</td>
</tr>
<tr>
<td>• Why?</td>
</tr>
</tbody>
</table>

*Figure 7. Sample slide from PowerPoint presentation for a Language Arts class: Summary.*
I found particularly interesting that this instructor facilitated a Language Arts learning experience (modelling the integration of ICT in a pedagogical way) for preservice teachers to experience as a learner and then revealed the pedagogical benefits of using this strategy of small group discussion with assigned roles from the viewpoint of a classroom teacher (FN3, pp. 9, 14). As seen in Figure 7, the instructions guide the preservice teachers to look for evidence of well-developed and under-developed oral skills in students while working in small groups.

Similar examples of course instructors planning to integrate ICT to facilitate classroom learning activities were also discovered in listening to preservice teachers’ stories. For example, one preservice teacher shared about a field trip that her class took for science:

We walked down with [CI1] as a class to a little ravine area with a stream. We worked in groups of three or four which we choose ourselves and each group had a hula hoop and two yardsticks. So, we found an area anywhere in the park and we put the hula hoop down--it could be up against a tree it could be on the grass it could be half in the water half on the bank and then we’d make four quadrants using the two yardsticks. We had to record our observations of what was in the hula hoops so the hula hoop was meant to be representative of a habitat and we had to talk about what we found in the habitat the different plant life species, yeah anything that was in there we were allowed to bring samples back of what we found with us and then once we came back I think it was the end of that class and then the following class we made observations and kind of had to put together a presentation of what we had found. (PT1-2, pp. 10-11)

She further explained that the preservice teachers were told to bring a digital camera or their smartphone to take digital pictures to record their observations, which would be included in their presentations of what they found. The preservice teachers then created a narrated photo story
(using PowerPoint, Prezi, etc.) upon returning to share with the class. This story is also shared later from the perspectives of preservice teachers.

**Research Question 3: Experienced Curriculum**

This research question asked how preservice teachers learn how to integrate ICT in teaching and learning and to what extent they actually develop and apply technological and pedagogical knowledge to integrate ICT within their practica. In the following section, I report on the supporting factors that were noted consistently as benefiting preservice teachers in integrating ICT in teaching and learning, as well as share comments and observations regarding their application of this learning in their practicum.

**Supporting factor 1: Strategic curriculum.** The B.Ed. program’s strategic curriculum, including all four subfactors presented earlier, significantly assisted preservice teachers in learning to integrate ICT in teaching and learning as evidenced by successful application during micro-presentations in their courses on campus as well as during their practicum.

**ICT course.** The preservice teachers overwhelmingly reported the development of technological knowledge in learning a multitude of ICTs in the dedicated ICT course that was taught in the first term. A common perspective from the preservice teacher participant group was the overwhelming nature of the concepts presented at a fast pace (PT5-1, p. 12; PT1-2, p. 10; PT2-2, pp. 15-16). For example, one preservice teacher described her experience in this way:

ICT class was probably the best but most confusing class! Every day it was like, ‘Okay, you can use this program and you can use that program and this one and this one and this one--play with them.’ and you’re like, oh god, it was hard to remember everything cuz there was so much in one class and a lot of it was ‘here’s some [software programs and websites] you can use’. I mean, we don’t have all the time that we would like so a lot of
the stuff you have to figure out on your own time--she would give us some key pointers but everything was so fast-paced, like running through each [ICT], it was very confusing.

(PT4-1, p. 15)

I probed how she kept up in the course in learning various ICTs to the extent that she could effective integrate them throughout the academic year for her lesson planning, micro-teaching presentations, and during her practicum. She responded:

[The course instructor] would have really detailed PowerPoints and also did tutorials, video tutorials, so you could go on her website and she’d have a step-by-step video tutorial for a certain program that she had done on her own time, which was awesome!

(PT4-1, p. 15)

Going further, one preservice teacher began to envision the use of ICT and other technology in her future classroom teaching. She explained her understanding from the ICT course was to use ICT appropriately as tools to facilitate teaching and learning, rather than a subject unto itself:

The whole point of the course was to learn about how to use ICT. I think for my students ICT is a means to an end, it’s the medium they’re going to use to do their work or to express their ideas and their opinions but I don’t think I’ll be grading them on their use of ICT so if there is that student or students who are more comfortable with the pen and paper activities and the art creations and the even the dramatic representation instead of the digital ones then by all means that’s fine-- I’m not going to ever assess them based on their ability to use ICT or I should say I would if it became part of the curriculum then I would. I know that science and technology that [technology and ICT] are part of the curriculum but in terms of any other subject if they don’t want to if they’re not comfortable using then that’s fine. (PT2-2, pp. 15-16)
This preservice teacher demonstrated a vision of how she would teach ICT in her own classroom as productivity tools to help her students demonstrate their learning, in a similar way that she was taught in the ICT course, recognizing that not all of her students may have the knowledge, skills, abilities, or even an interest in doing so.

**Teaching Methods course.** As with the ICT Course, preservice teachers mentioned the importance of the Teaching Methods course with respect to learning a multitude of teaching strategies (e.g., PT2-3, pp. 26-27; PT3-1, p. 13; PT4-1, p. 16). One preservice teacher described the comprehensiveness of the learning strategies taught in the Teaching Methods course and the course instructors’ use of the LMS in this way:

> Everything, absolutely, everything you would ever need to know about [teaching] curriculum and developing lesson plans is on [the LMS]...everything gets loaded into the course content area, all of our weekly activities, she’d tell us that is was we were learning and we could actually go into [the LMS] and find [the resources] of what she was actually teaching--she’s kind of modelling what she would expect from us to be able to do by the end of [the course]. (PT5-4, p. 8)

She then showed me how she access the LMS, bringing up various folders with “tons and tons of information” from the course, adding that it was her intention to download each one of the teaching strategy resources posted on the Teaching Methods course website on the LMS. Her comments provided support that, despite the cut back in hours for the Teaching Methods course from a 2-term year-long course to a single term to a single term 18-hour course, preservice teachers did not lack learning about effective teaching strategies and when to use them. Further, the comments from this preservice teacher suggested that she sufficiently learned about effective use of integrating ICT and teaching strategies. More specifically, she indicated that the Teaching
Methods course instructor actively modelled the teaching strategies in class and also online with respect to using the LMS, demonstrating how to organize files and content for preservice teachers to access and download when needed to complete assignments, plan lessons for the practicum and later work experiences. The instructor who developed the Teaching Methods course outline, shared her hope that preservice teachers appreciated that there was not enough class-time time to teach all of the available teaching strategies as well as integrate various ICTs with these teaching strategies. She openly acknowledged:

Okay, [the Teaching Methods] course may not be the best example of ICT [integrated with pedagogy] simply because the course hours were cut...given these limitations compared to previous years where I was able to integrate a lot more technology, so that’s unfortunate. (UA2, p. 3)

However, another preservice teacher commented on the effectiveness of the Teaching Methods course in teaching pedagogically sound teaching strategies with and without the integration of ICT. She shared her enthusiasm for what she was learning:

I’m learning more here and now than I feel like I’ve ever learnt through my entire education. For the most part [the course instructors] really do practice what they preach so when we’re learning in our Teaching Methods class how to engage students, how to do something other than standing at the front of the room and talking, which is really what I got all up until this point through elementary and high school -- a teacher standing at the front of the room talking. So, we do small group discussions, we do think, pair, share discussions, we do brainstorming, we do mind maps. [The course instructor] really does what she’s telling us we should be doing with our students and I find it so effective like I’m retaining so much more information than I ever have. (PT3-1, p. 13)
Indeed, the preservice teachers sufficiently learned effective teaching strategies and which ICTs support those teaching strategies to the extent that they were able to integrate both.

**Subject matter course.** The subject matter courses were reported to be beneficial for all preservice teachers in learning how to integrate ICT in teaching and learning activities. One preservice teacher shared a story about the effect of Faculty of Education’s goal to facilitate experiential learning for preservice teachers:

> It makes you understand how the student might feel—you see things from the students’ perspective, not just from the grown ups’ perspective of delivering information so I think you have a better understanding and I think you can prepare your lessons and your activities from a student-focus as well. (PT2-1, p. 5)

She continued to give examples of experiential learning in the math course, specifically, learning from peers’ micro-teaching presentations. For math, each micro-teaching activity was done in groups of five preservice teachers. Each group had to plan five learning activities for the other preservice teachers to complete in support of the math lesson being presented. Of the five activities, one had to include a learner-focused interactive whiteboard activity, a book (incorporating a Language Arts component to promote math vocabulary), a math-related website, and two hands-on activities with manipulatives to support the lesson (PT2-1, p. 18).

A similar story was shared about experiential learning in the Science & Technology course wherein the course instructor (CI1) taught her preservice teachers as she would a class of elementary students. A preservice teacher shared:

> [The course instructor] didn’t treat us like elementary students...it goes back to modelling. Modelling how you would do this as a teacher...it’s all the self-discovery, the making mistakes and learning from their mistakes that really solidifies their learning. If [a
student] doesn’t make mistakes when they’re going through it, they don’t learn anything.

(PT5-2, p. 6)

This form of discovery learning with hands-on experiments in the Science & Technology course was echoed by another preservice teacher:

There’s a constant noise level with the course, encouraged by [CI1], where she wants us to be talking and she wants the experiments to be noisy, and if they’re messy-that’s okay. I think when it’s quiet and clean, sometimes that’s indicative of the fact that people aren’t working or they’re not trying, or they’re not experimenting so I that she encouraged discussion and...to try things and if they fail that’s okay as long as you promoting safety and making sure measure are taken to keep everyone safe. I think it’s great that she lets us be so loud and rowdy and break things--you know it’s great for kids to experiment in that kind of way. (PT1-2, p. 25)

Yet another preservice teacher shared a story of using microscopes in science class and learning how the integration of ICT (i.e., digital microscopes) transformed the learning experience to a whole class learning activity compared to a time-limited, individualized learning experience of using traditional means (i.e., microscopes):

I’m thinking, this is great because if you use an optical microscope you only have one set of eyes that can be looking at one given time...what gets me really excited about [digital microscopes] is that you could have the entire class watching what is going on with one digital microscope--you plug it into your laptop and project it on the board and everyone can see, everyone can be engaged at the same time without having to wait their turn to look for two seconds. (PT3-2, p. 13)
In this example, the preservice teacher suggested that the instructor focused on the transformational capacities of the digital microscope to enrich the learning experience and engage the entire class.

Preservice teacher sentiments often included comments related to learning the subject matter content as well as learning how to teach the subject matter content in their own future classrooms with appropriate ICTs and teaching strategies (e.g., PT1-3, p. 12; PT3-1, p. 19; PT5-3, pp. 8-9). For example, as noted previously, the Faculty of Education were cognizant of the literature that many preservice teachers had problems understanding basic concepts in math and science. One preservice teacher was more comfortable with math concepts and had little need to learn math concepts as her peers did. For her, it was more about how to teach math:

There’s a lot of websites out there for primary and junior math I think I think I would definitely refer to them and use them when teaching mathematics. I know that in my practicum kids loved manipulatives--they loved if I taught a unit on money and on number sense they loved having the play money and they loved having being able to pretend to go…I think with math a lot of students who, for whatever reason, they have this intimidation or fear of math. There are so many math manipulatives available that I would have the option of technology but I wouldn’t have that be my number one teaching method I guess so you could even have a centre where the technology’s available there and you can set up a time schedule where each student gets at least a chance to go use the technology and try to use different math websites and there’s so many out there that are geared toward students but I would absolutely make sure that it’s also available for them to you know use these manipulatives as well. (PT1-2, pp. 22-23)
Indeed, my classroom observations of Mathematics, Science & Technology, Language Arts, and Social Studies all included experiential learning activities (e.g., FN1, pp. 27-32; FN2, pp. 19-21; FN3, pp. 24-30). Some were facilitated by the course instructors and others by preservice teachers doing their micro-teaching presentations.

**Math & Science days.** The Math and Science Days were equally beneficial to preservice teachers but to varying degrees. Most preservice teachers found that the Math and Science Days truly gave them a boost of confidence in personally understanding the respective subject matter content as well as to how to effectively teach the related concepts for math and science (e.g., PT2-2, p. 23; PT5-1, pp. 13-14), echoing the concerns about learning how to teach math and science that the university administrators and course instructors (e.g., UA1, p.16; CI2-3, p. 3) acknowledged -- namely, that preservice teachers do not have the requisite knowledge of (and confidence to teach) math and science. One preservice teacher had a math and science background reported that she was surprised at how much she learned with respect to the way in which the course instructors facilitated the learning activities for preservice teachers using contemporary teaching strategies, a hands-on, minds-on philosophy of having learners active with physical and digital manipulatives:

I remember when we had [Science Day] where we all were given a bunch of slides and supplies and we had to make a light bulb work with no real direction. So, you’re sitting there with a partner--now, try and figure it out with aluminum foil and batteries and a light bulb. It was a lot of trial and error and then when you got it, you could move on to the next step with two batteries or with a paperclip or with a switch...I tell you in that three-hour [session], I learned more about electrical engineering than I learned at
university 20 years ago. And I retained it--so it’s that going through and stumbling and learning from your mistakes along the way. (PT5-1, pp. 13-14).

Indeed, the math concepts were the same but she was learning different ways to learn (and eventually teach) math concepts in contrast to how she was taught when she studies electricity at university for her degree.

**Supporting factor 2: Standardized technology.** The data suggest that all three subfactors (i.e., mandatory laptops, interactive whiteboards & digital projectors, and software & websites) were critical in preservice teachers’ learning and eventual integration of ICT in their practicum. Although the preservice teachers had access to ICT while on campus, they often experienced limited access to ICT while on practicum. However, preservice teachers still demonstrated that they were thinking of missed opportunities with respect to how ICT could be integrated in classroom learning.

**Mandatory laptops.** The preservice teachers spoke at length about the mandatory laptops with diverging perspectives. Some positive experiences that preservice teachers had with the mandatory laptops included that the mandatory laptops facilitated compatibility with the B.Ed. ICTs (i.e..., interactive whiteboards, digital microscopes), which were also compatible with most school boards’ ICTs during the preservice teachers’ practicum (e.g., PT1-2, p.8, PT3-2, p. 13). One preservice teacher explained the importance of the laptop to her learning:

Everything is done on the laptop and I think you become very attached to it. It becomes like a fifth limb I guess and you always have access to the Internet -- like I said, Wi-Fi is everywhere...you always have access to everything you do. (PT4-1, p. 13)

One Faculty of Education document reinforced PT4s perspective writing, “The laptop is integral to the [teacher education] program and teacher candidates use information technology in a
variety of ways to enhance their learning (D17, p. 1). In addition, other preservice teachers
touted the benefit of the laptop for multitasking such as working on other assignments for other
courses, emailing peers to coordinate assignments, and following the course instructor’s lecture
(e.g., PT1-1, p. 17; PT3-2, p. 7; PT5-4, p. 9).

However, not all of the stories about mandatory laptops were positive. For example, one
preservice teacher talked about the distractions that the laptops caused in class:

You will have people who are, you know, on Facebook, or they are checking their emails,
or they’re on Skype, or whatever it is that they’re doing during lectures. Personally, it
doesn’t bother me so long as I can still hear the professor and I can see what’s going on--
it doesn’t really bother me. (PT1-1, p. 21)

This sentiment was also confirmed by UA4 who also stated that some preservice teachers are
distracted during practicum by having the laptop there and using it in inappropriate ways to the
extent that associate teachers expressed concerns with the practicum coordinator (UA4, p. 16).

I probed a bit further to ask PT1 about her personal strategies in dealing with the
distraction of the laptops. I asked, “Is there anything that you’ve put in place for yourself, like to
discipline yourself to avoid those distractions?” She promptly responded:

I closed my Facebook account when I started [this program]. I had one, and I think it was
the first couple of days--it really was ridiculous that everyone [in the class] was on
Facebook...I’ll have email open during lectures and I’ll have [the LMS] open constantly--
that’s the way we organize things so if we’re meeting up with our section members, then
we’ll email. (PT1-1, p. 21)
In this particular example, the preservice teacher took responsibility to manage the distractions that arose from having ubiquitous access to her laptop and the Internet. However, other preservice teachers did not mention the laptop being a distraction.

**Interactive whiteboards & digital projectors.** Preservice teachers had similar comments about how they learned to use interactive whiteboards and digital projectors in their own classroom teaching. Almost all classrooms at the Faculty of Education had an interactive whiteboard and digital projector. I observed preservice teachers using such ICTs in presenting their assignments (e.g., a micro-teaching assignment) during Math (e.g., FN1, pp. 28-30), Social Studies (e.g., FN3, pp. 24-26), and Language Arts (e.g., FN3, pp. 13-17) courses. Many preservice teachers mentioned that they learned how to use the interactive whiteboards and digital projectors through the dedicated ICT course, from watching their course instructors and peers model its use during their teaching sessions, and/or by simply playing around with the ICT in unused classrooms (e.g., PT2-1, p. 7; PT3-2, p. 10; PT4-2, p. 18; PT5-3, pp. 18-19).

**Supporting factor 3: Blended learning.** Preservice teachers benefited from use of the LMS and the in-class and online learning associated with the blended learning course design of the B.Ed. Program. This was evidenced in their practicum performance.

**LMS.** The preservice teachers benefited from a blended learning program delivery model. Specifically, the preservice teachers referred to the importance of the LMS. Many preservice teachers cited benefits of receiving course materials and submitting their assignments online (e.g., PT1-3, p. 6; PT2-2, p. 7; PT3-1, p. 15). Further, preservice teachers contributed to an online repository for lesson plans, spanning the elementary curriculum. For example, in the Science & Technology course, preservice teachers submitted their assignments for grading to their course instructor in hardcopy form as well as to the LMS for their peers to reference when
needed (PT1-2, p. 14). This use of the LMS provided ongoing support to preservice teachers during their practicum such that they could search and download specific lesson plans for their curriculum strands, essentially extending the classroom learning from Faculty of Education campus to the preservice teacher’s practicum site (UA3, p. 18; PT1-1, p. 7; PT5-4, p. 8). Further, preservice teachers made use of the LMS to create their own discussion board topics within their subject-matter content courses, ask questions, inquire about resources, and provide peer support to preservice teachers who needed it (PT2-3, p. 21; CI1-2, p. 9; UA4, p. 13; D18, pp.1-2).

Another preservice teacher commented about challenges that she experienced in navigating different courses taught by different course instructors on the LMS:

You have a course and every day you’re going into [the LMS] going, ‘Okay, [the course instructors], are they updating it?’ You know, cuz [the course instructors] would post ‘This is what you have to read this week or this is what you need to do this week’. Some [course instructors] were using [the LMS] for assignments, some of them to post course content, some of them do a curriculum overview document...it was really chaotic trying to grasp where all of that stuff was coming from and where you needed to look [on the LMS]...I mean , it takes you four to five weeks just to figure out the nuances of that individual [course instructor] to make you effective at what it is you are trying to get from [the LMS]. (PT5-4, p. 8)

Despite the chaotic experience she had in the first four to five weeks of the course, she identified some effective strategies with the LMS that her Teaching Methods course instructor used. This preservice teacher explained further while she accessed the LMS:

Everything, I mean everything, you would ever need to know about curriculum and developing lesson plans is on [the LMS]...[the course instructor] sorted it all out--here’s
all of our weekly activities--she’d tell us what it was that we were doing, we could actually go into [this section of the LMS], and this is actually teaching so you know she’s kind of modelling what she would expect from us to be able to do by the end [of the course]. (PT5-4, pp. 8-9)

The challenge of the varied use of the LMS by course instructors was acknowledged by the University and university administrators and made known to students so they would not be surprised by the variance in how some Faculty and course instructors used the LMS in different ways) (D12, p. 1; UA5, p. 14). However, as frustrating as it is was for PT5, it was apparent that she appreciated that the use of the LMS was organized and modeled by the Teaching Methods course instructor to deliver course content to promote understanding of the pedagogical use of the LMS to integrate ICT in teaching and learning.

*In-class and online learning.* The preservice teachers mentioned the importance of using various websites and online learning activities during class to learn how to use these online activities in their own future teaching. For example, one preservice teacher (PT1) explained her experience learning both in-class and online activities for her Language Arts class. The course instructor (CI2) had a balance of in-class activities that involved little to no use of ICT at times, focusing on physical hands-n learning activities in this way:

[CI2] has a whole tonne of resources. She likes using the activities that we would use as teachers; she does lecture, teaching by example, she provides story books and different resources that we can use and that includes flashcards or games or puppets, for example. She will always bring in something tangible that we can look at, examine, and discuss at our tables. Her PowerPoint presentation had [all of the resources] kind of linked in there. (PT1-2, p. 16)
She continued to explain how online learning activities were also important to learning various teaching strategies for Language Arts class:

Some of [CI2’s teaching strategies], I think she used in her time as a teacher…games and story books and puppets and flashcards…she’s got activity centres. I don’t know if she’s made them or bought them or borrowed them from the school library. I’m not always sure although that is referenced in her PowerPoint slides. She will have links to an e-workshop website or even just going to the Ministry of Education website and then links that you can find there. She linked YouTube videos… already embedded in her PowerPoint and I know it’s referenced where she gets them. (PT1-2, p. 16)

The incorporation of hands-on traditional learning in the classroom was supported with this course instructor’s PowerPoint presentation (D7), acting as an archive. Further, another preservice teacher mentioned that she liked classes such as this because of the teaching strategies used and access to online resources and learning activities (e.g., YouTube videos, e-workshops, the provincial Ministry of Education curriculum links) offered for download she could download the PowerPoint presentations from each class to refer to at a later date) (PT2-2, p. 5).

**Supporting factor 4: Integrated learning.** There was some inconsistency among preservice teachers with regard to the extent to which integrated learning contributed to their success in learning how to integrate ICT in teaching and learning. I discuss below the preservice teachers’ perspective on ICT and pedagogy integration in subject matter courses and the sum of their learning as demonstrated by using ICT in meaningful ways during the teaching practicum.

**ICT and pedagogy integrated in subject matter courses.** Preservice teachers reported mixed thoughts about the effectiveness of ICT integration in their courses. Some preservice teachers commented that ICT was either not integrated effectively or sometimes not at all (e.g.,
PT1-2, p. 14; PT4-1, p. 16). One preservice teacher talked about the limitations and opportunities in her science class:

There was no SMART Board in our Science class and we just had a [document camera] and digital projector. You could see where the [SMART Board] used to go on the wall but it had been taken down, not sure why. (PT5-2, p. 2)

Despite this limitation, she gave an example of when she initiated the integration of ICT to support the learning of her peers in one class:

We’re talking about bridge designs--you know stability of structures which is a grade 3 unit--we’re talking about the Tacoma, Washington bridge that collapsed and so I had mentioned that there was a YouTube video that showed the actual collapse that occurred. So, [the science teacher], brought that up and showed...this cement and steel structure start swaying until it actually broke apart. So, just that kind of stuff, bringing real life examples in what [the science course instructor] was doing to show the importance of it. (PT5-2, p. 2)

This story demonstrates that even when the course instructor was not integrating ICT in a particular lesson, this preservice teacher was thinking of how ICT (i.e., YouTube) could be used to enhance the lesson (i.e., using actual video footage from 1940 of the Tacoma Bridge breaking apart in high winds). Further, this supports the previously referenced Science course instructor’s comment about learning (CI3-1, pp. 7-8) ICT integration from the preservice teachers.

**Practicum: Using ICT in meaningful ways.** One university administrator (UA5) was responsible for facilitating the preservice teachers’ practicum. She shared numerous stories from current and previous years about the challenges faced in finding appropriate placements for preservice teachers to integrate ICT. Challenges included identifying school boards, schools, and
associate teachers (classroom teachers that mentored and supervised preservice teachers during their practicum) that had access to ICT learning resources (e.g., interactive whiteboards, Wi-Fi, classroom computers) and that would support the preservice teachers’ use of ICTs (e.g., UA5, pp. 7, 12, 14, 18). These challenges were similarly experienced by preservice teachers (e.g., PT1-1, pp. 9, 11; PT5-2, p. 24, PT4-1, p. 9).

There were mixed experiences among the preservice teachers with regard to the integration of ICT in teaching and learning during their practicum. There was a complete range of experiences from no use of ICT in the classroom, to full access to and use of ICT equipment. In one case, a preservice teacher explained that ICT was available in the school but not utilized:

I thought [the teachers] would use the computers more at the school I was at. We had a laptop cart with 15 laptops that the School Council helped purchases and I thought they’d be integrated more but it turned out that teachers weren’t really trained on the technology. (PT2-1, p. 2)

Her statement reinforced the need for this study, consistent with literature suggesting that teachers may not be effectively integrating ICT in the classroom (e.g., Kay, 2006; Zipke, 2018).

Another preservice teacher shared an interesting experience in which her integration of ICT during her kindergarten class practicum was limited due to the special needs of a student with a neurodevelopmental disorder (PT3-3, p. 10). Despite this, she made every effort to integrate ICT because it was a graded requirement. She shared:

In the afternoon we had a student with Autism that had [behavioural outbursts] every time the computer was turned on. So, that it makes it really difficult [to use the use computer in class]. He likes computers, he plays with computers all the time at home but likes video and he likes audio, but video and audio together is an overstimulation so he
couldn’t handle it. He had a meltdown last time we [used the video projector] with the movie. (PT3-3, p. 10)

This preservice teacher demonstrated that she was sensitive to the student’s needs and to the laptop requirement of her practicum. She went on to explain that she made changes to how she integrated ICT more so in the morning (i.e., when the student above would not likely be adversely affected) rather than in the afternoon. However, over time she recognized that her kindergarten class was not responding to her use of the laptop in the way she was expecting. She explained further, “I would have made a point of [using the laptop more] because the students kind of liked it but you could tell that even after two days the novelty of having to come to the laptop had worn off” (PT3-3, p. 10).

This story illustrates that even when preservice teachers have access to ICT, integration is not always appropriate, limiting the meaningfulness of its use (i.e., a particular student was negatively affected and the class as a whole seemed indifferent after the first couple of days). Essentially, PT3 demonstrated an understanding of not forcing the integration of ICT but rather integrating ICT as a tool to enrich the learning experience. She realized that her plan for integration of ICT was not effective. Therefore, she changed her strategy. For example, she used lesson plans that had students access www.raz-kids.com during their class computer lab time. Students worked independently to read through leveled books on their own computer (wearing headphones to reduce noise), complete comprehension quizzes, etc. Ultimately, she was able to demonstrate effective integration of ICT in meaningful (PT3-3, pp. 10-11).

Another preservice teacher mentioned limited opportunities to integrate ICT in her practicum. She expressed her frustrations with the limitations of access to ICT, namely using an interactive whiteboard during her practicum, “I’m 0 for 3 as far as interactive whiteboard
availability [in my practicum]” (PT5-3, p. 5). This limitation to integrate some ICTs (namely interactive whiteboards) in the classroom due to limited or no access was echoed by UA4 (p. 7). However, that did not deter PT5 from integrating ICT to the extent possible. Despite limited access to ICTs in her practicum school, she relied on her university mandatory laptop and her own digital camera to integrate ICT in her practicum:

On my first placement we took a trip to an outdoor education facility and I had taken digital pictures and I ended up putting those into a digital photo story and sharing it with the class. So even taking [my mandatory laptop] and being able to incorporate it in the class was great because the class I was in did not have SMART Boards or a laptop computer in the classroom. But bringing in my laptop and using YouTube videos to teach kids how to learn to count by twos--you know was useful for that kind of stuff. So, bringing in the [mandatory laptop] into the classroom and using it that way, I had never thought of using technology in the classroom before. (PT5-1, p. 2)

Her story of taking pictures and turning them into a digital photo story is an important example of the transferability of the preservice teachers’ learning experiences in the B.Ed. program to their practicum. This particular story is similar to the field trip discussed above when CI1 planned for her science class where the preservice teachers walked to a nearby park, took pictures a marked off area, and returned to class to make a digital presentation of their findings (CI1-1, p. 16; PT1-2, p. 10). Indeed, preservice teachers were learning how to integrate ICT as first-hand learners as promised by the academic calendar (D1, p. 64) discussed previously.

Another preservice teacher shared a similar story regarding use of her laptop to produce digital presentations for math lessons:
I made a [narrated photo story] to do a lesson in math. I had done a problem, we were teaching equations, and I had done a problem and I took snapshots of each step that I did and then I recorded my voice...and then put it on [for the class]. I was still giving the instruction-- I started doing equations [on the board] and I saw that they weren’t interested so I said what if I give a lecture but through a computer would they be interested so that’s kind of what I did. So, I had the equation and I basically went through the steps and recorded that and put it together [as a photo story] and played it so it was kind of like a short film. I talked about the problem and working out word problems and creating equations from a word problem and that sort of thing. [The class] was more interested in listening to the ‘computer me’ talk than ‘me talk’ so it was kinda interesting.

(PT4-3, p. 4)

I probed further as to the origins of this idea to create a narrate photo story to teach a math lesson. She said that the course instructor who taught the dedicated ICT course modelled narrated digital tutorials (photo stories with pictures as well as screen capture videos), demonstrating how to use various ICTs (software, websites, etc.) and these digital tutorials. She mentioned that she found the digital tutorials very effective:

[The course instructor] would post it so you could watch the tutorial and listen to her explain it. It was nice because I could go back if I missed something or I could repeat something or I could play it when it was convenient for me and when I actually needed it...I really liked that idea like creating these tutorials on the computer. (PT4-3, p. 4)

As she continued, it was clear that learning how to create custom narrated videos from the ICT course had been transferred into her teaching practicum as a way to provide a similar learning
experienced for her students. For example, her students would repeat the video, watching it as they needed it. Indeed, this example from PT4 supports the integration of ICT in practicum.

**Results Summary**

In sum, four supporting factors (Strategic Curriculum, Standardized Technology, Blended Learning, and Integrated Learning), each with two to four subfactors, were identified as being critical to effectively prepare preservice teachers to integrate ICT in teaching and learning. The examples presented in this chapter span multiple data sources including representations from all the research participants, numerous documents, and fields notes made from personal observations. Further, each of these supporting factors imply actions that took place within the context of the planned, enacted, and experienced curriculum.

In the following chapter I discuss the theoretical and practical implications of these findings. Theoretical implications include validation of Ertmer’s (1999) First and Second Order Barriers framework, Mishra and Koehler’s (2006) TPACK framework, and Puentedura’s (2006, 2009) SAMR framework as discussed in the literature. More importantly, the results of this study suggest the need to consider all three frameworks simultaneously to effectively prepare preservice teachers to integrate ICT in teaching and learning in the planned, enacted, and experienced curriculum. Further, the results of this study demonstrate that the TPACK can be used as a prescriptive framework, identifying a sequential process for preparing preservice teachers to integrate ICT in teaching and learning. Finally, practical implications are presented to provide direction to B.Ed. program administrators, curriculum developers, and school boards as to how to support preservice and in-service teachers to integrate ICT in teaching and learning.
CHAPTER 5: DISCUSSION

As discussed in Chapter 1, the primary purpose of this research was to understand the supporting factors that prepare elementary preservice teachers to integrate ICT in teaching and learning. In Chapter 2, I identified a gap in the literature and discussed the need to build on existing theory to effectively prepare preservice teachers to integrate ICT in teaching and learning (Kay, 2006; Zipke, 2018). This would benefit teacher education programs by guiding their planning and delivery of the curriculum. Three prominent themes of supporting factors were identified in the literature as important for teacher education programs in preparing preservice teachers to integrate ICT (i.e., standardized technology, blended learning course designs, the integration of the ICT throughout the teacher education program). Further, several theoretical models were identified as contributing to understanding effective ICT integration: Ertmer’s (1999) First and Second Order Barriers, TPACK (Mishra & Koehler, 2006), and SAMR (Puentedura, 2006, 2009). However, independently, none adequately present a curriculum model that comprehensively explains what teacher education programs should do. As such, the overarching goal of the current research was to identify and understand the supporting factors that prepare elementary preservice teachers to effectively integrate ICT in teaching and learning.

I conducted a qualitative case study, collecting data from a preservice teacher education program at a Canadian university. I examined relevant university, program, and course documents, observed classroom lessons, and conducted semi-structured interviews with university administrators, course instructors, and preservice teachers. My research questions explored the supporting factors at the intended, enacted, and experienced curriculum. That is, I sought to understand the actions taken to prepare preservice teachers to integrate ICT in teaching and learning by the University and program administrators and course instructors as well as
understand the experiences of preservice teachers, including the extent to which they applied their learning during their practicum.

Triangulation of the data from the intended, enacted, and experienced curriculum suggests the existence of four primary supporting factors (each with several subfactors). Consistent with the extant literature, the findings indicate that standardized technology and blended learning are, indeed, supporting factors. The results of this study build on the existing literature by showing that strategic curriculum is also crucial to preparing preservice teachers to integrate ICT in teaching and learning, and that integrated learning plays a more complex role than originally believed. Moreover, teasing apart the curriculum into its intended, enacted, and experienced components shed some light on how existing theoretical models might be combined usefully into a prescriptive framework that adequately explains how preservice teacher education programs can best prepare preservice teachers to integrate ICT in teaching and learning. Thus, the findings of this study support and extend previous research and theory on preparing preservice teachers to integrate ICT in teaching and learning. Further, the findings of this study offer practical insights about teaching preservice teachers to integrate ICT effectively in their future careers.

Below I discuss my findings in relation to the three critical theoretical frameworks discussed in previous chapters. First, I present the theoretical implications of the findings stressing the importance of combining Ertmer’s (1999), Mishra’s and Koehler’s (2006), and Puentendura’s (2006, 2010) frameworks to effectively prepare preservice teachers to integrate ICT in teaching and learning. Second, I highlight the practical implications of the findings to inform B.Ed. programs, program administrators, and school boards that want to prepare preservice and in-service teachers to integrate ICT. Third, I will discuss issues of trustworthiness.
and credibility of the findings, the limitations of this work, and how those limitations might be addressed in future research. I close this dissertation with a brief summary of its contributions.

**Theoretical Implications**

As with all case studies, the findings of this research need further testing and confirmation. However, the data point to a number of useful contributions to the literature. First, the results of this study support Ertmer’s (1999), Mishra and Koehler’s (2006), and Puentendura’s (2006, 2010) theoretical frameworks as discussed in the literature. Second, the results of this study extend understanding of these frameworks and underscore their interconnectedness as being critical to the integration of the four supporting factors to prepare preservice teachers to integrate ICT in teaching and learning within the planned, enacted, and experienced curriculum. Finally, the results of this study contribute to the extant literature by extending the TPACK framework, revising the visual representation of the TPACK framework from a Venn diagram to a hierarchical framework. In doing so, the TPACK framework becomes more prescriptive in nature. Despite departing from original TPACK theory (Mishra & Koehler, 2006), the findings of this case study suggest that there may be strategic benefits associated with the development of core knowledge domains (technological, pedagogical, and content) prior to the development of integrated knowledge domains (e.g., TCK, TPACK). This sequencing may occur within courses and across courses within a strategic curriculum. With further testing and validation, this finding could offer important guidance in developing technological, pedagogical, and content knowledge in practice.

**Implication #1: Overcoming First and Second Order Barriers with the Supporting Factors**

As discussed in Chapter 2, Ertmer’s theory (1999) suggests that, to effectively integrate ICT in teaching and learning, both first and second order barriers must be overcome. First order
barriers concern functional access to ICT whereas second order barriers concern attitudes and beliefs about ICT integration. The findings of this study support this framework by demonstrating that particular supporting factors function to overcome first and second order barriers. For example, strategic curriculum was found to be a supporting factor that overcame first and second order barriers. Having a strategic curriculum that includes a dedicated ICT course facilitated the development of technological knowledge to the extent that preservice teachers were aware how to access and use various ICTs (e.g., interactive whiteboards, digital microscopes, various software applications) to overcome first-order barriers. Second-order barriers were reportedly overcome with integrated learning. Participants discussed how learning to integrate ICT in pedagogically meaningful ways raised their self-efficacy so they felt comfortable integrating ICT during their practicum, even in circumstances where the associate teacher had limited experience with ICT. Further, the current study extends Ertmer’s theory by suggesting that first and second order barriers map onto distinct components of the curriculum.

More specifically, in the context of this case study, first order barriers were primarily addressed by the supporting factors within the intended curriculum whereas second order barriers were addressed by the supporting factors within the enacted curriculum.

In this study, the intended curriculum overcame first order barriers in a number of ways. First, a vision for campus-wide ICT was developed through the establishment and maintenance of a technology infrastructure (e.g., Wi-Fi, printers in classrooms, hallways, and libraries). Second, standardized technology was used to overcome limitations and challenges regarding access to ICT in-class and during preservice teachers’ practicum (e.g., mandatory laptops and the LMS intended for preservice teacher collaboration and resource-sharing), to hardware and software cost (e.g., bulk purchase of educational software to reduce individual costs), and to
hardware-software compatibility. Third, open-use protocols provided preservice teachers with the ability to independently access and use ICT related resources (e.g., interactive whiteboards, digital microscopes, digital cameras). Finally, functional access for course instructors was facilitated by various formalized support systems, including a teaching and learning centre and a dedicated IT help centre, to support course instructors’ integration of ICT in their teaching to model effective ICT integration for preservice teachers.

Supporting factors were evident in the enacted curriculum level. The supporting factors at this level seemed to overcome second order barriers such as preservice teachers’ attitudes toward integrating ICT and their confidence in doing so in their own teaching. For example, comments from all participant groups included examples of how course instructors regularly modelled specific methods to effectively integrate ICT in their classes. This, coupled with preservice teachers’ own demonstrations of technology integration, micro-teaching sessions on campus, and teaching during their practicum, helped to strengthen their knowledge of and confidence in using ICTs in teaching. Course instructors (in particular the ICT course instructor) further strengthened preservice teachers’ confidence in integrating ICT by teaching learning-on-demand strategies for use of new and emerging ICTs.

Despite the University’s and Faculty’s efforts to overcome first and second order barriers, examination of data relevant to the experienced curriculum suggests that some barriers remained. For example, in a social science subject-matter class I observed, the Internet was down for the entire period, impeding the ability of the course instructor to carry out her lesson plan. Similarly, preservice teachers working off campus (e.g., from home or during practicum) experienced first order barriers with respect to reliable high-speed Internet access. This presented obvious challenges for preservice teachers to access the LMS and course learning materials to prepare
lesson plans for their classroom teaching and access websites, multimedia, and other online resources for use in the classroom. Another residual first-order barrier evidenced in the data concerned the functionality of ICTs. In one particular classroom there was a wall primed for an interactive whiteboard, yet the interactive whiteboard was removed for repair and was not reinstalled over the course of the academic year. In another classroom the whiteboard was not functional, suggesting a failure to properly maintain existing ICT. Thus, despite best efforts toward the intended and enacted curriculum, first-order barriers can randomly occur, disrupting the learning experience in the experienced curriculum.

Implication #2: A Revisioning of TPACK as a Prescriptive Framework

The findings of this study suggest that the development of TPACK existed throughout all curriculum components. As part of the intended curriculum, the strategic curriculum facilitated the development of TK, PK, and CK by having a dedicated ICT course, a dedicated teaching methods course, and subject-matter content courses (e.g., Math and Science & Technology). Similarly, standardized technology supported the development of TK by preservice teachers’ daily use of their laptop and associated standardized software and websites. The blended learning course designs enacted by the course instructors also supported the development of TPACK as preservice teachers participated in meaningful pedagogical learning experiences in class using various ICTs (e.g., interactive whiteboards, digital microscopes) as well as online using the LMS to collaborate with peers (e.g., discussion boards, lesson plan repository). Integrated learning facilitated by course instructors (i.e., enacted curriculum) contributed to the development of TPACK as evidenced by their modelling of ICT integration and the course requirements (e.g., preservice teachers’ lesson plans and micro-teaching sessions). Finally, TPACK was evident in the experienced curriculum as preservice teachers integrated ICT in their practicum (e.g.,
teaching students to create photo stories and videos). Further, preservice teachers who had limited or no access to ICTs in their practicum demonstrated evidence of TPACK with respect to what they would have done if they had access to ICTs (e.g., Internet in the classroom, digital microscopes). As such, the current findings showed support for the TPACK framework.

Traditionally, the TPACK framework has been descriptive in nature (Mishra & Koehler, 2006). That is, TPACK identifies the specific knowledge domains that teachers need in order to integrate ICT in teaching and learning, namely, TK, PK, CK, TPK, PCK, TCK, and TPACK. Although TPACK theory indicates that effective learning occurs at the intersection of the knowledge domains, implying that these domains are completely interdependent, the current findings suggest that there may be some value in strategic development of at least some of these domains. Specifically, the data suggest that there may be practical benefit from developing the core domains independent from the integrated domains. Indeed, in practice, it may be quite challenging for a preservice teacher with limited core knowledge to learn and apply TPACK all at once. The findings of the current study build on TPACK theory by suggesting that the model may also be viewed as prescriptive in nature.

I found evidence that TK, PK, and CK were developed in the following order: (1) having a dedicated ICT course, a dedicated teaching methods course, and subject-matter content courses, respectively (2) learning how to use ICT effectively as a meaningful pedagogical tool in the dedicated ICT and teaching methods courses, and (3) developing TPACK in content specific courses (e.g., Math, Science, Language Arts). In sum, TK, PK, and CK were developed within the dedicated ICT course, the teaching methods course, and the subject-matter courses as a first step before preservice teachers began to learn to integrate TPK, PCK, and ultimately TPACK.
The structure of a strategic approach in having the ICT and Teaching Methods courses in the first term of the program implied a sequential strategy in having preservice teachers first develop TK, PK, and CK. In fact, participants commented on the importance of first developing knowledge of ICTs (TK) and teaching methods (PK) while learning basic concepts in their subject-matter content courses (CK). As the first term carried on, preservice teachers gradually developed TPK in the ICT course, learning how specific ICTs could be used in teaching and how they could be effective for learning (taught in the Teaching Methods course).

Preservice teachers gradually developed TPK in their teaching methods course, learning how to integrate specific ICTs (taught in the ICT course) to effectively plan meaningful learning experiences. Further, preservice teachers developed PCK in their subject-matter content courses as they applied the teaching strategies learned in the teaching methods course to specific subject-matter content. For example, in science, the preservice teachers talked about the importance of “the hook” in Science class. The hook is a whole-class pedagogical strategy to engage learners at the start of a lesson (e.g., a demonstration or experiment) that piques the learners’ interest in the concept being taught before moving to small group activities wherein learners try to make sense of the demonstration or experiment by themselves. By the second term, preservice teachers reported that they were regularly doing micro-teaching sessions in their subject-matter content courses integrating ICT in meaningful ways—essentially demonstrating TPACK.

The sequential nature of developing TPACK in this case study became evident during my analysis as I reconfigured the TPACK framework from the traditional Venn diagram (Figure 4) to a hierarchical representation as displayed in Figure 2, represented again below.
This interpretation of the TPACK model is intended to develop TPACK knowledge domains beginning at the base of the triangle developing TK, PK, and CK, then working upward to develop TPK and PCK, and ultimately TPACK. This revisioning of the TPACK framework from the Venn diagram format to the hierarchical format may offer utility for teacher education programs, program administrators, and school boards preparing preservice teachers to integrate ICT as discussed in further detail in the Practical Implications section below. In summary, the revisioning of the TPACK framework is an important contribution to the literature as it may provide a roadmap to effectively develop TPACK in a sequential manner, something that seemed to work well, at least for this case teacher education program.

**Implication #3: SAMR, Because TPACK is Not Enough**

As discussed in Chapter 2, I explored how TPACK was developed as a descriptive model to explain the requisite knowledge domains needed for teachers to integrate ICT in teaching and learning. Indeed, I observed and heard from all participant groups that course instructors
essentially had developed TPACK as they demonstrated the integration of ICT with a pedagogical purpose in their subject-matter courses. However, it became apparent that the demonstration of TPACK was not enough for meaningful integration of ICT in teaching and learning activities. As previously stated, it was a clear intention of the teacher education program to have course instructors integrate ICT in teaching their courses (i.e., the intended curriculum) and I observed course instructors demonstrating integration of ICT in their teaching (i.e., the enacted curriculum). However, preservice teachers raised some questions and reported some concerns about how course instructors were actually integrating ICT in their teaching (i.e., the experienced curriculum). For example, some preservice teachers commented that the interactive whiteboard in some courses were mostly used as a screen to display PowerPoint presentations. Arguably, this may not be the most effective integration of this particular ICT in teaching and learning.

In other cases, preservice teachers reported how some course instructors used the LMS in a limited way to distribute course handouts and make announcements to the class. Essentially, the preservice teachers were critical of the limited use of ICT enacted by the course instructors. Even though the course instructors demonstrated TPACK in their teaching, the results of this study imply that TPACK is not enough to ensure rich, meaningful learning experiences in practice. This finding is consistent with research suggesting that TPACK does not necessarily result in the effective integration of ICT (e.g., Brantley-Dias & Ertmer, 2013). These findings suggest that an additional framework may be useful to assess the quality of the ICT integration in practice. One such framework that seemed to fit well with the data from this study is the SAMR model (PuenteDura, 2006, 2009).
As noted in Chapter 2, the SAMR model (Puentedura, 2006, 2009) includes four categories: substitution, augmentation, modification, and redefinition. Each of these levels of ICT integration quality were evidenced in the current study. For instance, the use of a basic PowerPoint presentation to facilitate a lecture merely substituted handouts for preservice teachers to follow along in class with no functional change for the course instructor or the preservice teacher. They were looking at a screen as a substitute for a piece of paper. Augmentation was observed in how course instructors used the LMS to accept, grade, and provide feedback on preservice teachers’ assignments online. Functional improvements were realized in that preservice teachers were able to view their mark and read their feedback as the course instructors graded their assignments. That is, the preservice teacher did not need to wait until the next class to receive their assignments back to review the course instructors’ feedback. Modification was evident in how course instructors used the LMS to create a repository of preservice teachers’ lesson plan assignments. All of the preservice teachers commented on the benefit of having access to peers’ assignments for use in creating their own lesson plans during their practicum, especially when they had limited time to prepare to teach a specific strand and grade level of the curriculum. Finally, redefinition was seen in how preservice teachers independently collected, analyzed, and organize information, wrote and recorded narration to create photo stories to demonstrate their learning.

Having knowledge of technology, pedagogy, and subject-matter content was not enough to effectively integrate ICT in teaching and learning as demonstrated by their course instructors, on occasion. It is certainly reasonable to acknowledge that each course instructor was also learning how to effectively integrate ICT in teaching and learning. Indeed, all of the course instructors commented on the learning curve coming to the University, learning how to use the
LMS, the laptop, and various ICTs that they had not used in their own previous teaching and learning experiences. Preservice teachers seemed to demonstrate critical thought of how the course instructors were modelling ICT integration, consistent with the SAMR framework and existing empirical evidence (e.g., Koch et al., 2012). For example, preservice teachers talked about how they would integrate ICT differently in their own teaching as compared to how their course instructor demonstrated its use. That is, the preservice teachers were building on the examples of how the course instructors integrated ICT (e.g., substitution) to a higher category for a richer learning experience (e.g., redefinition). To be clear, preservice teachers spoke positively in reflections about their experience in this regard and certainly in no way criticized their course instructors. The preservice teachers were simply thinking aloud about how they would have done things differently in using various ICTs to enrich the learning experience. As such, aspects of the SAMR model seem to be used by the preservice teachers to assess the level, or quality, of ICT integration achieved by the course instructors.

Further, the SAMR framework appeared to be a missing piece of the puzzle for teacher education programs to assess the quality of preservice teachers’ demonstrated TPACK in their micro-teaching sessions and during their practicum. The simple use of ICT demonstrated during practicum should not be a ‘yes or no’ tick box for evaluation of the experienced curriculum. Rather, consideration should be given to the suitability of the demonstrated TPACK and how ICT is being integrated at various categories of the SAMR framework to enrich the learning experience. Further, recent literature suggests that the learning context should also be considered (Hamilton, Rosenberg, & Akcaoglu, 2016).

There is a time and a place (i.e., context, as Hamilton et al., 2016 purport) for ICT to be integrated in teaching and learning consistent with the SAMR framework. Indeed, ICT should be
integrated with a pedagogical purpose that supports the learners’ age and stage of development and knowledge of ICT. That said, not all ICT integration learning activities need to lead to a redefined learning experience. Further, while the SAMR framework is presented in a hierarchical model (Figure 2), it does not imply that the higher levels of modification and redefinition are the ultimate goal or are somehow better. The SAMR framework offers utility in categorizing the use of ICT to facilitate learning and should be matched accordingly with the goals of the learning outcomes, the age and stage of development of the learner, etc. to assess the quality of preservice teachers’ integration of ICT. For example, the use of basic word processing software (e.g., MS Word) to write a poem as a substitute for printing by hand is appropriate for early primary grades (i.e., kindergarten to grade two) because children this young are still learning how to use the keyboard. However, using basic word processing software in secondary school might be considered inappropriate as other options such as multi-user, cloud-based word processing software (e.g., Google Drive) would be more appropriate because students at this age are fairly versed in using a keyboard. The learning experience of typing online with multiple users in a cloud-based environment redefines the learning experience whereby students can collectively and simultaneously participate in viewing, editing, and/or adding comments to each other’s work both in and out of school. To be clear, there is nothing wrong with word processing being used as a substitution for traditional pen and paper tasks as long as it is context appropriate (i.e., pedagogically meaningful) for the age and stage of development of the students. Based on the findings of this study, teacher education programs can benefit from using SAMR as a discussion point for maximizing the effective integration of ICT in teaching and learning for both course instructors and preservice teachers.
Practical Implications

This study has a number of practical implications for preservice teacher education programs that want to emphasize the integration of ICT in teaching and learning. Below, I discuss the practical implications of the four supporting factors within the context of the intended, enacted, and experienced curriculum. I do so from a generalized perspective within the context of this case study, recognizing that the detailed findings of this study require further exploration and replication. Based on the rich details provided about this case site in previous chapters, B.Ed. program administrators and school board curriculum developers can consider how the results of this study might apply to their circumstances for preparing preservice and in-service teachers on how to integrate ICT in teaching and learning.

Intended Curriculum

The intended curriculum is planned by university and faculty administrators. Generally speaking, a strategic approach for a preservice teacher education program would include consideration for learners to first develop technological knowledge, pedagogical knowledge, and subject-matter content knowledge independently of each other. This is consistent with Figure 2. Consideration should be given to developing preservice teachers’ technological knowledge within a formal course, series of workshops, etc. to the extent that preservice teachers can feel comfortable using it, consistent with the findings of Figg and Jaipal-Jamani (2011). Likewise, consideration should be given as to how preservice teachers can develop their pedagogical and subject-matter content knowledge, independent of each other before learning how to combine these knowledge domains (i.e., TPK and PCK) in an effort to develop and demonstrate TPACK (Mishra & Koehler, 2006). Further, this sequencing of developing technological knowledge, pedagogical knowledge, and subject-matter content knowledge independently helps preservice
teachers to overcome second-order barriers with respect to building confidence in first learning about and how to use various ICTs and how to integrate them within their teaching in a meaningful way.

Making a recommendation with respect to standardized technology for a teacher education program is challenging. With new and emerging ICTs brought to the educational market, it is near impossible to predict what ICTs will be available within, let alone adopted by, elementary schools. For example, the teacher education program in this study used a mandatory laptop program. During my interviews, it was acknowledged by one of the university administrators that the University was researching the next iteration of standardized technology. Further, this participant went on to say that the emphasis should not be on specific ICTs but rather the broader consideration for standardized technology. In this way, administrators should give careful thought to issues of standardized technology to ensure access, compatibility, and support for all course instructors and preservice teachers. By doing so first-order barriers to technology integration can be overcome (Ertmer, 1999).

Blended learning is an important consideration for teacher education programs. The LMS is the backbone of online course delivery, facilitating communication between course instructors and preservice teachers, and accessing shared resources while on practicum. The choice of an LMS should be informed by these goals. The in-class and online learning experience also requires consideration for the design of classrooms to accommodate access to the internet via Wi-Fi, power outlets to charge personal devices, and presentation technologies that are accessible and compatible with personal devices to facilitate face-to-face learning.

Integrated learning at the intended curriculum level focuses on the incorporation of various ICTs by preservice teachers in meaningful ways during their practicum. This supporting
factor is a challenge for administrators because the practicum takes place outside of their
purview. As presented in the Chapter 4, in the current study, some preservice teachers had access
to ICTs whereas others did not. This can vary from school to school, even within the same
school board. Therefore, considerations for placements for practicum should include a ‘Plan B’
for those preservice teachers who either do not have access to ICTs within their practicum
schools or who are teaching under the supervision of associate teachers who do not support the
integration of ICT in their classroom. For example, a Plan B might include encouraging
preservice teachers to facilitate ICT integration workshops via professional activity days for
associated school boards and schools, working with the university’s teaching and learning centre
to facilitate workshops for course instructors, or creating video tutorials to demonstrate the
integration of various ICTs. By doing so, administrators can facilitate teaching opportunities for
those preservice teachers who otherwise are not able to demonstrated integrated learning as
intended by their university.

**Enacted Curriculum**

The enacted curriculum is planned for and delivered by course instructors. With respect
to strategic curriculum, associated course instructors may be able to support the intended
curriculum through cooperation and communication across the dedicated ICT course, teaching
methods course, and subject-matter courses. Subject-matter course instructors may have little
time and/or knowledge of various ICTs or specific teaching methods to teach in their class. For
example, a subject-matter course instructor may ask the ICT course instructor to teach preservice
teachers how to make multimedia presentations, thus, allowing the subject-matter course
instructors to integrate ICT in their classes without having to teach those ICT-related
skills. Further, elementary math and science course instructors should consider ensuring that
their preservice teachers demonstrate mastery of the elementary math and science curriculum before learning how to teach these subjects in meaningful ways with ICT. Teaching remedial math and science concepts may be required for some preservice teachers prior to the formal start of the term. For example, math and science assessments may help identify those preservice teachers that require remedial support. Online tutorials teaching math and science concepts (perhaps the result of a Plan B discussed above) can be access prior to the formal start of the academic year to ensure that all preservice teachers have the requisite subject-matter knowledge for math and science.

While the course instructors may not have the authority to mandate standardized hardware (e.g., mandatory laptops, interactive whiteboards), they may be able to ensure that the software, websites, and online resources are accessible by all preservice teachers on campus and while on practicum. For example, subject-matter course instructors can use the LMS to facilitate an online repository of preservice teacher-developed lesson plans that preservice teachers can access while on practicum. Further, subject-matter course instructors may keep an updated list of useful low/no cost educational websites that preservice teachers can access within schools to integrate in their teaching as well as encourage students to access independently outside of class on any personal device. By doing so, this facilitates access to vetted online educational learning resources that can be used by preservice teacher’s on-campus, while on practicum, and by their students at home.

Course instructors need to acknowledge the existence of their university’s LMS and take it upon themselves to learn how to effectively deliver their courses online in a meaningful way. Course instructors can take advantage of the university’s teaching and learning centre and accessing online tutorials (perhaps the result of a Plan B as discussed above). Course instructors
are encouraged to go beyond simple substitution of the LMS to deliver their courses and focus on more meaningful learning experiences. For example, course instructors can use the LMS to build foundational knowledge through online learning activities to be completed prior to class. As a result, face-to-face class time can focus on application and experiential learning activities.

Course instructors should consider the integration of ICT and pedagogy in their subject-matter courses. There are two considerations for this. First, subject-matter course instructors should be modelling integration of ICT in meaningful ways in their own teaching. Second, course instructors should consider the development of preservice teachers’ TPACK over the term, gradually challenging preservice teachers to demonstrate their TPACK through assessments, peer-evaluations, micro-teaching sessions, etc.

**Experienced Curriculum**

The experienced curriculum refers to the perspectives of preservice teachers and what (and how) they learned to integrate ICT in teaching and learning. Ideally, the experienced curriculum will align with the intended and enacted curriculum. However, this may not always be the case. Therefore, it is critical for administrators to monitor and assess the experiences of preservice teachers to ensure congruence with the intended curriculum. For example, a pre/post survey to measure preservice teachers’ self-efficacy in integrating ICT in teaching and learning can be used to identify and overcome second-order barriers (Wang, Ertmer, & Newby, 2004). Likewise, an assessment instrument can be used to track the development of TPACK (Schmidt et al., 2009). And, the SAMR model can be used to categorize and assess the depth and richness of ICT integration (Puentedura, 2009). Finally, administrators can assess congruence between the intended curriculum and the experienced curriculum via course evaluations completed by preservice teachers as a means of quality control.
It is also important to ensure congruence between the intended and enacted curriculum. This can be accomplished by monitoring course instructors’ teaching through self and peer evaluations and formal performance appraisals. Support services for course instructors to integrate ICT in teaching and learning are also recommended to mitigate any discrepancies. For example, a teaching and learning centre can provide instruction to course instructors on how to use various ICTs and integrate them in meaningful ways and an IT support centre can assist course instructors in overcoming first order barriers to ensure that ICTs are working properly and/or promptly repaired.

In summary, preservice teachers will benefit from a well-planned curriculum if instructors deliver their courses in a manner consistent with the intentions of the teacher education program. Broadly speaking, the supporting factors identified in this study and recommendations discussed in this chapter can help preservice teacher education programs to create a curriculum that will effectively prepare preservice teachers to integrate ICT in teaching and learning.

**Trustworthiness of the Findings**

As with all qualitative research, it is important to analyze the trustworthiness of the current findings. In this section, I address four key criteria for establishing the trustworthiness of qualitative data recommended by Guba and Lincoln (1982) namely, credibility, transferability, dependability, and confirmability.

**Credibility**

Credibility refers to how true or accurate the findings of a study are (Lincoln & Guba, 1985). A variety of strategies exist for evaluating the credibility of qualitative research findings (Anney, 2015; Lincoln & Guba, 1985; Sikolia, Mason, Biros, & Weiser, 2013). In the section
below, I address various strategies taken to ensure the credibility of the results of this study including encouraging honesty of respondents and participant checks, data saturation, thick description, triangulation, and consistency with established findings.

Participants were encouraged to be open and honest and respond candidly about their experiences. They were unknown to the researcher, volunteered to participate, and were not compensated, thereby minimizing the chance that participants would feel obligated to respond in particular ways. Further, participants were informed about the purpose of the study and signed the appropriate consent form (Appendices D-F). They were informed that there were no right or wrong answers and that their responses would be aggregated with other participant responses and other data collected over the course of the second term of the B.Ed. program (including information from extant documents and classroom observations. I summarized and paraphrased participants’ responses during interviews to ensure accuracy of my records. Finally, I referenced the audio recordings of the interviews with research participants to double-check the accuracy of my written notes, making revisions as necessary. As a result, I am confident that the responses reported in this dissertation are credible.

I immersed myself in the data throughout the study to ensure that I had collected sufficient data to reach the point of saturation before I began to organize the data and look for patterns. The research design included multiple sources of data collection including participant interviews (33 interviews in total between 16 participants), classroom observations (6 total between four courses), and the collection of countless pages of documents (including the academic calendar, preservice teacher assessments, course instructor syllabi, and other university and B.Ed. program-related information). I doubt that further interviews with preservice teachers, course instructors and/or university administrators, collection and analysis of more documents
(e.g., course syllabi, assignments, etc.), or more classroom observations would reveal any new insights or lead to different conclusions. Indeed, I collected data to the point of saturation and the results of the data were organized and reported on the basis of the patterns and implications that emerged from the data, rather than on the basis of my own inferences.

I provided thick description of the research methods in Chapter 3 to the extent that another researcher could reasonably replicate this study. Further, thick description was used extensively in Chapter 4 with extensive descriptions of, and quotes from, the participants, various documents, and my personal observations. As a result, it should be apparent that the factors and subfactors to prepare preservice teachers to integrate ICT in teaching and learning are accurately based in the data collected.

As noted above, I gathered data from multiple sources including research participants (eight university administrators, three course instructors, and five preservice teachers) with the course instructors and preservice teachers having at least three interviews each, the direct observation of multiple classes (two Math, two Science, one Language Arts, and one Social Science), and the review of a number of documents provided by university administrators and documents available on the University’s website, course syllabi provided by course instructors, and copies of assignments provided by preservice teachers. The findings (i.e., the supporting factors) reported in this dissertation came about as a result of the triangulation of multiple sources of data leading to the patterns identified through my analysis, thus underscoring the trustworthiness of the findings.

Finally, the findings presented in my study are consistent with the existing literature discussed in Chapter 2. The new insights presented in this chapter (e.g., the importance of First and Second Order Barriers, TPACK, and SAMR used in conjunction with each other, TPACK as
a prescriptive framework, etc.) to prepare preservice teachers to integrate ICT in teaching and learning, though novel, are a natural extension of existing research. Indeed, the goal of producing trustworthy research findings was paramount in my research design planning, data collection, analysis, and interpretation of results.

**Transferability**

Transferability refers to the extent to which results can be transferred to other similar contexts. Transferability can be difficult to establish for a case study. Indeed, there are several factors at play in the current research that may limit the transferability of the findings. For instance, data were collected from a single Canadian university preservice teacher program. Therefore, the findings may not be transferable to other preservice teacher programs. Similarly, the sample size might be scrutinized because it is not representative—again, limiting the transferability of the findings. Therefore, for case study research, it becomes important to explore the boundaries for transferability. Scholars have proposed that it is possible for practitioners to apply research results to their situation if they can demonstrate that their study situation and the researched situation are comparable (Bassey, 1981). Consistent with this notion, Lincoln and Guba (1985) argue that researchers must provide ample information in their research report to enable others to assess whether the findings are transferable to their own context. Following from this, Bitsch (2005) contends that the transferability of findings is facilitated by using “thick description and purposeful sampling” (p. 85). As reported in this dissertation, I have provided thick description; I have provided thorough description of the research site, participants, context, methodology, analytic strategies, and interpretation. These efforts should enable other researchers to determine if the current findings would be transferable to other contexts of interest.
A second way to ensure transferability involves purposive sampling, or purposefully selecting particular individuals or groups to collect data from (e.g., Anney, 2015). Indeed, I was quite purposeful in recruiting participants from all important stakeholder groups, and, based on participant input, elaborated this sampling part way through to include an additional category of stakeholders that I had not thought of originally (note, this can also be seen as a member check, further supporting the credibility of the findings). By collecting perspectives from preservice teachers, faculty, and administrators, I was able to capture a representative sample of varying perspectives that occur in a real educational program setting, thus strengthening the transferability of the findings.

**Dependability**

Dependability refers to the stability or reliability of the findings (Bitsch, 2005). I used several strategies to ensure dependability of my findings. First, during analysis I engaged in several rounds of coding and recoding until I arrived at consistent agreement. This ensures that the patterns and categories of data are internally reliable. Second, consistency between different types of data collection also support the dependability of the findings. Specifically, evidence of the supporting factors identified in the interviews was found in document analysis. Third, similar to ‘peer checks’ (Bitsch, 2005) or audit trails (Morrow, 2005), Shenton (2004) notes that the study should be reported with in-depth coverage to allow other researchers to replicate the work and to enable an assessment of the extent to which proper research practices have been followed. As noted above, ample detail has been provided for this research study to be examined and assessed by others (e.g., dissertation advisor, dissertation committee). Finally, as suggested by Lincoln and Guba (1985), demonstration of credibility tends to indicate dependability. The
preceding discussion supporting the credibility of the current work suggests that the findings are also dependable.

**Confirmability**

Central to confirmability is the demonstration that the findings of the study are due to the information provided by the informants rather than due to beliefs and biases of the researcher (Shenton, 2004). In essence, for the study to be confirmable, the researcher must be neutral. In Chapter 1, I describe my personal perspectives and experiences that could potentially influence my interpretation of participant responses. Indeed, my own experiences as a teacher and avid user of technology may impact how I interpreted participant responses. However, I outlined the various ways in which I aimed to curb any potential personal biases throughout the study. For example, I was conscious of my bias while collecting and analyzing the data and focused my attention on the shared reality of the research participants, organizing the participants’ responses into themes and categories that answered the research questions. I provided rich description and direct quotes of their experiences and perspectives in Chapter 4 to demonstrate evidence of this shared reality. Further, I provided explanations for the choices I made throughout the research process to underscore that decision points were based on objective analysis and not merely personal preferences. The fact that the supporting factors identified through analysis of interview data were corroborated across participant groups (i.e., preservice teachers, faculty, and administrators), as well as across different methods (i.e., observation and document analysis) supports the confirmability of the current findings.
Limitations and Future Research

As with any research study, there are limitations to be acknowledged. Building on the limitations and delimitations acknowledged in Chapter 1, in this section, I further discuss limitations of this case study and suggest next steps for future research.

This case study provided a snapshot of the planned, enacted, and experienced curriculum of a B.Ed. program at a single Canadian university based on qualitative data collection methods over the course of a single academic term. The B.Ed. program’s intention to prepare preservice teachers to integrate ICT in teaching and learning was clear and was actively promoted to prospective preservice teacher candidates and faculty. The research participants (eight university administrators, three course instructors, and five preservice teachers) represented only a fraction of the total teaching faculty (course instructors, tenure and tenure-track faculty) in the elementary stream, let alone the total population of preservice teachers in the elementary and secondary stream. As a result, there are limitations on the transferability of the results of this study.

Time was a limitation on this study. I collected data during the second academic term of the B.Ed. program. For future research, I would consider a longitudinal study collecting data throughout the entire B.Ed. program as well as track the preservice teachers’ application of ICT integration in teaching and learning as they transitioned into their own classrooms. A longitudinal study would allow me to observe some of the supporting factors that the participants discussed in the first term of the program (e.g., Math Day, the ICT Course, the Teaching Methods course) and provide more in-depth description of the participants’ challenges and how they overcame them in learning how to integrate ICT in teaching and learning. Further, a longitudinal study that tracked preservice teachers as they transitioned into their own classrooms would answer questions such as, To what extent do preservice teachers integrate ICT in their
teaching practice? and What are common first and second order barriers that new in-service teachers face in their classroom and to what extent did their perception of their preservice teacher education prepare them to overcome these barriers? These research questions would provide further evidence for the supporting factors to prepare preservice teachers to integrate ICT in teaching and learning.

This study relied on solely on qualitative methodology. During my data collection and subsequent analysis, I identified additional interesting research questions that could not be answered using the current qualitative research method. For example, at one point during my data collection, I questioned the extent to which preservice teachers learned how to integrate ICT in teaching and learning as a function of the B.Ed. program. It is certainly possible that some preservice teachers might already have developed sufficient TPACK prior to starting the program. Quantitative data collection methods would help answer this question by using a - and post-data collection instrument to measure the preservice teachers’ development of TPACK over the course of the program.

Finally, the preservice teachers that participated in this study specifically chose this particular B.Ed. program, presumably because they had a specific interest in learning how to integrate ICT in teaching and learning. This limitation led me to question the extent to which the supporting factors presented in this study would equally prepare preservice teachers in other B.Ed. programs that do not have a specific focus on ICT integration. For example, other B.Ed. programs may need to focus more time and curriculum resources in helping preservice teachers overcome first and second-order barriers. Preservice teachers in a non-mandatory laptop B.Ed. program without Smart Boards in every classroom may experience first-order barriers to ICT to practice using such technology on campus and/or during their practicum. Further, I question
whether second-order barriers such as self-efficacy, having a vision for, and willingness to, integrate ICT in teaching and learning, etc. would need to be addressed in a different way at a B.Ed. program that does not have a specific mandate to prepare preservice teachers to integrate ICT in teaching and learning. As mentioned in Chapter 2, the realities of the 21st century curriculum require teachers to integrate ICT in teaching and learning. However, it is possible that other types of B.Ed. programs have different challenges (and supporting factors) to overcome.

Measuring preservice teachers’ demonstrated knowledge of ICT integration in teaching and learning (i.e., TPACK) as well as the suitability and effectiveness of the integration (i.e., SAMR) will be an ongoing challenge for researchers. ICT and high technology continue to evolve within the public-school systems. Preservice teacher programs are continually challenged to prepare preservice teachers to overcome first and second order barriers to integrate ICT in teaching and learning. A common trend at the time of writing is the Bring Your Own Device model, whereby students bring their own tablet, laptop computer, and/or smartphone to school. To what extent will the classroom teacher be responsible to ensure compatibility and technical support to individual students accessing the teaching and learning materials? Future research must be adaptable to such ongoing changes and how they might impact the preparation of preservice teachers to integrate ICT in teaching and learning.

**Conclusion**

This case study identified four key supporting factors that teacher education programs can use to help prepare preservice teachers to integrate ICT in teaching and learning. Further, the data suggest that a tri-theoretical lens that integrates Ertmer’s (1999), Mishra and Koehler’s (2006), and Puentendura’s (2006, 2010) theoretical frameworks may be a useful strategic approach to preparing preservice teachers to integrate ICT. Finally, the data suggest a revisioning
of the TPACK (Mishra & Koehler, 2006) model that results in a more prescriptive application of TPACK. Despite answering the research questions of this study and contributing to the educational literature, some outstanding questions exist. For example, to what extent do these supporting factors exist within other B.Ed. programs? To what extent is there a difference between standard B.Ed. programs and B.Ed. programs that have a strategic approach to preparing preservice teachers to integrate ICT and B.Ed. program? Additional questions to measure preservice teachers’ development of TPACK in a B.Ed. program with pre-, mid-, and post-program surveys would help elucidate the development processes of establishing TPACK within a B.Ed. program as it relates to the four supporting factors. Further, the results of this study also raise questions for school boards and in-service teachers. To what extent do these supporting factors exist in school boards wanting to prepare in-service teachers to integrate ICT in teaching and learning?

The results of this study contribute to the extant literature within the field of ICT and preservice teacher education programs. More specifically, the results are relevant to researchers and scholars with an interest in applying theory (e.g., First and Second Order Barriers, TPACK, and/or SAMR) to learn more about preparing preservice teachers to integrate ICT in teaching and learning. Further, the results of this study may also be beneficial to practitioners in the field, namely school boards and administrators looking to develop ICT integration with in-service teachers.

In closing, I was somewhat surprised at the simplicity of the results. I hoped to discover some magical way of preparing preservice teachers to integrate ICT in teaching and learning. However, that was not case. Rather, it was a well-planned curriculum paired with good teaching that seemed to effectively prepare preservice teachers to integrate ICT. More importantly, a well-
planned curriculum and good teaching are dynamic and changing along with changes to ICTs available in society; the Faculty of Education studied herein met this goal. On the topic of the integration of ICT in teaching and learning, Krista Moroder (personal communication March 5, 2018) said it best, “Great teaching hasn’t changed. The toolbox has.” The broader research question for B.Ed. programs is clear to me now: How do universities and faculties of education effectively prepare preservice teachers to continually learn how to integrate ICT in teaching and learning over the course of their teaching careers? Integrating ICT in teaching and learning is an ever-changing and a life-long commitment. What ICTs will be available in society five, ten, and 25 years from now? No one can answer that question, let alone speak to the implications of how to integrate such ICTs in the classroom. However, until then, we must add to our toolbox as new ICTs become available.


Lim, C. P., Yan, H., & Xiong, X. (2015). Development of preservice teachers’ information and communication technology (ICT) in education competencies in a mainland Chinese


https://www.edonline.sk.ca/bbcswedav/library/curricula/English/English_Language_Arts/English_Language_Arts_4_2010.pdf


http://schoolweb.tdsb.on.ca/Portals/elearning/docs/ICT%20Standards.pdf


September 27, 2010

Mr. Robert Horgan
Ph.D. Candidate
Faculty of Education
Duncan McArthur Hall
Queen’s University

Dear Mr. Horgan:

GREB Ref #: GEDUC-520-10
Title: “Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning”

The General Research Ethics Board (GREB), by means of a delegated board review, has cleared your proposal entitled “Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning” for ethical compliance with the Tri-Council Guidelines (TCPS) and Queen’s ethics policies. In accordance with the Tri-Council Guidelines (article D.1.6) and Senate Terms of Reference (article G), your project has been cleared for one year. At the end of each year, the GREB will ask if your project has been completed and if not, what changes have occurred or will occur in the next year.

You are reminded of your obligation to advise the GREB, with a copy to your unit REB, if applicable, of any adverse event(s) that occur during this one year period (details available on webpage http://www.queensu.ca/ors/researchethics/GeneralREB/forms.html – Adverse Event Report Form). An adverse event includes, but is not limited to, a complaint, a change or unexpected event that alters the level of risk for the researcher or participants or situation that requires a substantial change in approach to a participant(s). You are also advised that all adverse events must be reported to the GREB within 48 hours.

You are also reminded that all changes that might affect human participants must be cleared by the GREB. For example you must report changes in study procedures or implementations of new aspects into the study procedures on the Ethics Change Form that can be found at http://www.queensu.ca/ors/researchethics/GeneralREB/forms.html - Research Ethics Change Form. These changes must be sent to the Ethics Coordinator, Gail Irving, at the Office of Research Services or irvingg@queensu.ca prior to implementation. Mrs. Irving will forward your request for protocol changes to the appropriate GREB reviewers and / or the GREB Chair.

On behalf of the General Research Ethics Board, I wish you continued success in your research.

Yours sincerely,

Joan Stevenson, PhD
Professor and Chair
General Research Ethics Board

c.c.: Dr. Peter Chin, Faculty Supervisor
Dr. Lesly Wade-Woolley, Chair, Unit REB
E-REB: o/o Graduate Studies & Bureau of Research, Attn: Celina Freitas

JS/gi
APPENDIX B: LETTER OF INFORMATION - COURSE INSTRUCTORS

This research is being conducted by Robert Horgan, a doctoral candidate at the Faculty of Education at Queen’s University in Kingston, Ontario. This study was granted clearance by the General Research Ethics Board for compliance with the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans, Queen's policies, and the [University] Research Ethics Board. Robert Horgan is neither a student with nor employed by [the University] in anyway.

**What is this study about?** The purpose of this research is to identify and understand the supporting conditions in preparing preservice teachers to integrate technology in teaching and learning. The study will require approximately seven hours of your time and entail participating in a series of three, 60-minute personal interviews and being observed teaching two classes between January-April 2011. The first interview will ask questions about the steps you take in designing learning experiences to prepare preservice teachers to integrate technology in your teaching. Subsequent interviews will ask questions about your thoughts and reflections of the observed teaching sessions. During the classroom observations, I will focus on the use of technology in the teaching and learning activities of the class. You will also be asked to provide a copy of the course outline/syllabus, assignment sheets, and other documents used in your teaching. There are no known physical, psychological, economic, or social risks associated with this study.

**Is my participation voluntary?** Yes, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. You may also withdraw at any time with no effect on your employment with [the University] by advising me in person or by email. Any data collected from you will be destroyed and will not be considered in the study.

**What will happen to my responses?** We will keep your responses confidential to the extent possible. Only the researcher, the research assistant, and research supervisor will have access to this information. Interviews will be audio recorded. A research assistant may be employed to transcribe the interviews. Field notes will be taken during the interview and classroom observations. All electronic data will be stored on a password-protected personal computer with a single back-up copy stored on a password-protected Queen's University computer. Existing
records will be secured for five years and then destroyed as per current policy and all other copies deleted or destroyed. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings. Confidentiality is assured to the extent possible. The names of the participants and the University will remain anonymous. If the data are used for secondary analysis, they will contain no identifying information.

**Will I be compensated for my participation?** No. There is no compensation for your participation in this study.

**What if I have concerns?**

Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613-533-6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.
APPENDIX C: LETTER OF INFORMATION - PRESERVICE TEACHERS

This research is being conducted by Robert Horgan, a doctoral candidate at the Faculty of Education at Queen’s University in Kingston, Ontario. This study was granted clearance by the General Research Ethics Board for compliance with the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans, Queen's policies, and the [University] Research Ethics Board. Robert Horgan is neither a student with nor employed by [the University] in anyway.

**What is this study about?** The purpose of this research is to identify and understand the supporting conditions in preparing preservice teachers to integrate technology in teaching and learning. The study seeks to recruit five preservice teachers. Should more than five preservice teachers volunteer, they will be selected through random selection. The study will require approximately seven hours of your time and entail participating in a series of four personal interviews between January 2011-April 2011. The interviews will ask about your experiences in the teacher education program and how you are learning to integrate technology in teaching and learning activities. You will be asked to bring to the interview any lesson plans you have created for your instructors or during your teaching practica as well as assignments that demonstrates how your knowledge of ICT integration in the classroom. You will also be invited to blog periodic reflections over the course of the term (approximately 15 minutes per week). There are no known physical, psychological, economic, or social risks associated with this study.

**Is my participation voluntary?** Yes, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. You may also withdraw at any time with no effect on your standing in school by advising me in person or by email. Any data collected from you will be destroyed and will not be considered in the study.

**What will happen to my responses?** We will keep your responses confidential to the extent possible. Only the researcher, the research assistant, and research supervisor will have access to this information. Interviews will be audio recorded. A research assistant may be employed to transcribe the interviews. Field notes will be taken during the interview and classroom observations. All electronic data will be stored on a password-protected personal computer with
a single back-up copy stored on a password-protected Queen's University computer. Existing records will be secured for five years and then destroyed as per current policy and all other copies deleted or destroyed. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings. Confidentiality is assured to the extent possible. The names of the participants and the University will remain anonymous. If the data are used for secondary analysis, they will contain no identifying information.

**Will I be compensated for my participation?** No. There is no compensation for your participation in this study.

**What if I have concerns?** Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613-533-6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.
This research is being conducted by Robert Horgan, a doctoral candidate at the Faculty of Education at Queen’s University in Kingston, Ontario. This study was granted clearance by the General Research Ethics Board for compliance with the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans, Queen's policies, and the [University] Research Ethics Board. Robert Horgan is neither a student with nor employed by [the University] in anyway.

**What is this study about?** The purpose of this research is to identify and understand the supporting conditions in preparing preservice teachers to integrate technology in teaching and learning. The study will require approximately one hour of your time and entail participating in a single personal interview between January-April 2011. The interview questions include inquiring about various University policies that affect the teacher education and how they contribute to preparing preservice teachers to integrate ICT in teaching and learning. You may be asked to submit copies of various documents that reference related policies and practices discussed during the interview. These documents will be reviewed to understand the extent that such policies and practices are realized in the Bachelor of Education program. You should not feel obliged to provide any documents that make you feel uncomfortable. There are no known physical, psychological, economic, or social risks associated with this study.

**Is my participation voluntary?** Yes, you should not feel obliged to answer any material that you find objectionable or that makes you feel uncomfortable. You may also withdraw at any time with no effect on your employment with [the University] by advising me in person or by email. Any data collected from you will be destroyed and will not be considered in the study.

**What will happen to my responses?** We will keep your responses confidential to the extent possible. Only the researcher, the research assistant, and research supervisor will have access to this information. Interviews will be audio recorded. A research assistant may be employed to transcribe the interviews. Field notes will be taken during the interview and classroom observations. All electronic data will be stored on a password-protected personal computer with a single back-up copy stored on a password-protected Queen's University computer. Existing
records will be secured for five years and then destroyed as per current policy and all other copies deleted or destroyed. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings. Confidentiality is assured to the extent possible. The names of the participants and the University will remain anonymous. If the data are used for secondary analysis, they will contain no identifying information.

**Will I be compensated for my participation?** No. There is no compensation for your participation in this study.

**What if I have concerns?** Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613-533-6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.
APPENDIX E: CONSENT FORM - PRESERVICE TEACHERS

Name (please print clearly): __________________________________________

1. I have read and retained a copy of the Letter of Information and Consent Form and have had any questions answered to my satisfaction.

2. I understand that I will be participating in the study called Preparing preservice teachers to Integrate Information and Communication Technology in Teaching and Learning.

3. I understand that this means that I will be asked to participate in a series of four personal interviews (each lasting approximately 60 minutes) to discuss my experiences in the Bachelor of Education program at the University, submit copies of lesson plans and assignments, and to periodically blog my reflections over the fall term (total amount of seven hours required). I understand that the interviews will be audio recorded.

4. I understand that I will be not compensated for my participation.

5. I will not reveal the identities of the other participants associated with the study.

6. I understand that my participation in this study is voluntary and I may withdraw at any time with no effect on my standing in school. Should I wish to withdraw, I understand that I may request removal of all or part of the data I have provided where possible. I understand that every effort will be made to maintain the confidentiality of the data now and in the future. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality.

7. Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613 533 6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.

I have read the above statements and freely consent to participate in this research:

Please sign and return one copy of this Consent Form and return to Robert Horgan. Retain the second copy for your records.
Participant's Name: ________________________________

Signature: ________________________________ Date: ________________

Please include an email or postal address should you wish to receive a copy of the results of the study.

Email: ________________________________

Address: ________________________________

City: ________________________________

Province: ________________________________ Postal Code: ________________
APPENDIX F: CONSENT FORM – COURSE INSTRUCTORS

Name (please print clearly): ____________________________________________

1. I have read and retained a copy of the Letter of Information and Consent Form and have had any questions answered to my satisfaction.

2. I understand that I will be participating in the study called Preparing preservice teachers to Integrate Information and Communication Technology in Teaching and Learning.

3. I understand that this means that I will be asked to participate in a series of three personal interviews (each lasting approximately 60 minutes) to discuss my experiences teaching in the Bachelor of Education program, allow the researcher to observe me teaching two classes and that I will also be asked to submit copies of various teaching documents (total amount of seven hours required). I understand that the interviews will be audio recorded.

4. I understand that I will not be compensated for my participation in the study.

5. I will not reveal the identities of the other participants associated with the study.

6. I understand that my participation in this study is voluntary and I may withdraw at any time. Should I wish to withdraw, I understand that I may request removal of all or part of the data I have provided where possible. I understand that every effort will be made to maintain the confidentiality of the data now and in the future. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality.

7. Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613 533 6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.

I have read the above statements and freely consent to participate in this research:

Please sign and return one copy of this Consent Form and return to Robert Horgan. Retain the second copy for your records.

Participant's Name: ________________________________
Signature: ________________________________________ Date: ________________

Please include an email or postal address should you wish to receive a copy of the results of the study.

Email: __________________________________________

Address: ________________________________________

City: ____________________________________________

Province: __________________________ Postal Code: ________________
APPENDIX G: CONSENT FORM – UNIVERSITY ADMINISTRATORS

Name (please print clearly): _______________________________________

1. I have read and retained a copy of the *Letter of Information* and *Consent Form* and have had any questions answered to my satisfaction.

2. I understand that I will be participating in the study called Preparing preservice teachers to Integrate Information and Communication Technology in Teaching and Learning.

3. I understand that this means that I will be asked to participate in a single personal interview lasting approximately 60 minutes to discuss various University policies that affect the Bachelor of Education program at the University and that I will be asked to submit various documents referencing such policies. I understand that the interviews will be audio recorded.

4. I understand that I will be not compensated for my participation.

5. I will not reveal the identities of the other participants associated with the study.

6. I understand that my participation in this study is voluntary and I may withdraw at any time. Should I wish to withdraw, I understand that I may request removal of all or part of the data I have provided where possible. I understand that every effort will be made to maintain the confidentiality of the data now and in the future. The data may also be published in professional journals or presented at scientific conferences, but any such presentations will be of general findings and will never breach individual confidentiality.

7. Any questions about study participation may be directed to Robert Horgan at robert.horgan@queensu.ca or my supervisor Dr. Peter Chin at peter.chin@queensu.ca or 613 533 6000 extension 79556. Any ethical concerns about the study may be directed to the Chair of the General Research Ethics Board at 613-533-6081 or chair.GREB@queensu.ca.

I have read the above statements and freely consent to participate in this research:

**Please sign and return one copy of this Consent Form and return to Robert Horgan. Retain the second copy for your records.**

Participant's Name: ___________________________
Signature: ________________________________ Date: ________________

Please include an email or postal address should you wish to receive a copy of the results of the study.

Email: __________________________________________

Address: ________________________________________

City: ____________________________________________

Province: ________________________________ Postal Code: ________________
APPENDIX H: SAMPLE INTERVIEW QUESTIONS – PRESERVICE TEACHERS

1. How did you come to be in the teacher education program at the University?
   • What other Universities did you apply to? What attracted you to apply to those programs?
   • What were some of the important considerations in choosing this University compared to others?
   • What are your expectations from taking this program?

2. Tell me about your experience with information and communications technology (ICT) in teaching and learning.
   • To what extent did your teachers use ICT in elementary, secondary, or post-secondary?
   • To what extent have you used ICT as a student in elementary, secondary, or post-secondary?
   • To what extent have you used ICT in a teaching role (peer mentor, teaching assistant)?

3. Please describe technologies that your instructors used in the Class-A, Class-B, or Class-C during face-to-face interactions.
   • Which technology was most helpful to you? Why?
   • Which technologies were new to you?
   • To what extent can you see yourself using those technologies in your own teaching?
   • To what extent were those technologies explained as to why they were being used?

4. Please describe technologies that your instructor used in the delivery of Class-A, Class-B, or Class-C for online interactions.
   • Which technology was most helpful to you? Why?
   • Which technologies were new to you?
   • To what extent can you see yourself using those technologies in your own teaching?
   • To what extent were those technologies explained as to why they were being used?

5. Describe how you felt about learning with technology during face-to-face interactions?
   • Did your initial feelings change over the course of the term? If so, why?
6. Describe how you felt about learning with technology during online activities?
   - Did your initial feelings change over the term? If so, why?

7. To what extent did your confidence in using educational technology change over the term?
   - What were some activities that lead to this change?

8. Discuss your level of satisfaction/dissatisfaction with the face-to-face learning activities.
   - To what extent did the use of educational technologies increase or decrease this satisfaction?

9. Discuss your level of satisfaction/dissatisfaction with the online learning activities.
   - What types of educational technologies had the highest influence on your level of satisfaction?

10. To what extent did you integrate technology in your practice teaching session?
    - What technologies did you use?
    - To what extent were you exposed to these technologies in the B.Ed. program?
    - How did you go about preparing a lesson plan that integrated educational technology?

11. To what extent did you use your laptop in your practice teaching session for planning and administrative tasks?
    - What software did you use?
    - To what extent were you exposed to the software in the B.Ed. program?

*Note: Additional questions will emerge from classroom observations and initial interviews.*
APPENDIX I: SAMPLE INTERVIEW QUESTIONS – COURSE INSTRUCTORS

1. I’d like to learn about your opinions and use of technology in your personal and professional life.
   - Tell me about the different types of technology you use in your personal life.
   - Tell me about the different types of technology you use in your professional life.
   - To what extent does your personal use of technology inform your teaching practice?
   - To what extent does your professional use of technology inform your personal use?

2. Tell me about your experience with information and communications technology (ICT) in teaching and learning.
   - To what extent have you used ICT as a student in elementary, secondary, or post-secondary?
   - To what extent have you used ICT in a teaching role prior to teaching at the University?

3. Tell me about your background in teaching in a B.Ed. program.
   - Have you taught this or other post-secondary elsewhere? Tell me about that experience.
   - What technologies are currently available to you and preservice teachers in teaching Language Arts?
   - What technologies have you incorporated into your teaching? How did you learn about integrating those technologies in teaching and learning?
   - What teaching strategies do you use? Where did you learn about those strategies?

4. Tell me about your experience teaching Language Arts in an elementary classroom.
   - What grade(s) did you teach?
   - What technologies were available to you in the classroom and within the school?
   - How does your experience of teaching in the classroom inform your teaching of the subject to preservice teachers?
• What teaching strategies that you used in the classroom are also successful in teaching B.Ed. students?
• What technologies were available to you and your students when you taught Language Arts in the classroom?

5. Tell me about how you have prepared to teach the Language Arts course for the upcoming term.
   • What was the process in the development of the course syllabus, in-class activities, and course assignments?
   • How have they changed over since you first taught the course?
   • What supports are available at the University to learn about and how to integrate technology in teaching and learning?
   • Please describe any supports, if any, that you have used.

6. I'd like to learn about the recruitment and selection of course instructors in the Bachelor of Education program.
   • What criteria is used to select applicants?
   • What types of questions are used to inquire about a candidate's experience using/teaching with ICT?
   • What types of orientation activities are available for new instructors?
     o To what extent do those activities focus on the development of ICT skills (WebCT) and teaching in a laptop environment?
   • What types of teaching and/or ICT-related activities are available throughout the year?

7. What ICT resources are made available to all course instructors?
   • To what extent is there any follow up to ensure that instructors are using the resources effectively?
   • What supports are available for instructors that experience problems with the ICT (hardware/software)?
8. Tell me about the development of the Bachelor of Education program.

- What was the initial vision for the program?
- What was this vision based on? (Market analysis, trends in higher education, anticipated need, research?)
- How has the Bachelor of Education program changed since it started?
- What is the future direction of the program?
- What influences do the following identities have in providing direction to the program with respect to the use of ICT:
  - University Policy
  - Centre for Teaching and Learning
  - Ontario College of Teachers
  - Teaching Profession (Local Schools, Teacher Unions, etc.)
  - Tenured Faculty
  - Adjunct Faculty
  - Curriculum Documents
  - Alumni
1. I’d like to learn about the recruitment and selection of course instructors in the Bachelor of Education program.
   - What criteria is used to select applicants?
   - What types of questions are used to inquire about a candidate’s experience using/teaching with ICT?
   - What types of orientation activities are available for new instructors?
     - To what extent do those activities focus on the development of ICT skills (WebCT) and teaching in a laptop environment?
   - What types of teaching and/or ICT-related activities are available throughout the year?

2. What ICT resources are made available to all course instructors?
   - To what extent is there any follow up to ensure that instructors are using the resources effectively?
   - What supports are available for instructors that experience problems with the ICT (hardware/software)?

3. Tell me about the development of the Bachelor of Education program.
   - What was the initial vision for the program?
   - What was this vision based on? (Market analysis, trends in higher education, anticipated need, research?)
   - How has the Bachelor of Education program changed since it started?
   - What is the future direction of the program?
   - What influences do the following identities have in providing direction to the program with respect to the use of ICT:
     - University Policy
     - Centre for Teaching and Learning
     - Ontario College of Teachers
     - Teaching Profession (Local Schools, Teacher Unions, etc.)
- Tenured Faculty
- Adjunct Faculty
- Curriculum Documents
- Alumni
Greetings,
I am doctoral candidate from the Faculty of Education, Queen's University writing to invite you to participate in research study based at (name of University). I acquired your email address from the Office of the Dean, Faculty of Education. This research study has been cleared by (name of Dean, Faculty of Education, University).

The study, Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning seeks to understand the supporting conditions to prepare elementary preservice teachers to integrate technology in teaching and learning activities.

I understand that you are scheduled to teach (name of curriculum course) during the fall term. As such, you are being invited to participate in this study. Your involvement in the study will require your participation in three personal interviews (each lasting approximately 60 minutes) and require your permission to observe you teach two classes at a mutually agreed upon time. You will also be asked to submit various teaching-related documents. The total time commitment for your participation in this study is approximately seven hours.

More details about the study will be provided in a Letter of Information. A presentation about the study to take place on (date, time, location) to learn more about the study and ask questions. Light refreshments will be available.

Should you be interested in participating, please refer to the Letter of Information and provide me with an email address so I can contact you with further details.

Sincerely,

Robert Horgan
Doctoral Candidate
Faculty of Education, Queen's University
Hello,

My name is Rob Horgan. I am doctoral candidate from the Faculty of Education, Queen's University writing to invite you to participate in research study based at (name of University). This research study has been cleared by (name of Dean, Faculty of Education, University).

The study, Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning seeks to understand the supporting conditions to prepare elementary preservice teachers to integrate technology in teaching and learning activities.

Your involvement in the study will require completion of four personal interviews (each lasting approximately 60 minutes) to learn of your experiences learning how to integrate ICT in teaching and learning activities. You will be asked to submit copies of lesson plans and various assignments completed over the term. You will also be invited to periodically blog reflections over the course of the term. The total time commitment for your participation in this study is approximately seven hours.

Should you be interested in participating, please refer to the Letter of Information and contact me by email (robert.horgan@queensu.ca) with an email address so I can contact you with further details.

Sincerely,

Robert Horgan
Doctoral Candidate
Faculty of Education, Queen's University
Greetings,

My name is Rob Horgan. I am doctoral candidate from the Faculty of Education, Queen's University writing to invite you to participate in research study based at (name of University). (NAME) Dean, Faculty of Education, University, advised me to contact you regarding participating in this study.

The study, Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning seeks to understand the supporting conditions to prepare elementary preservice teachers to integrate technology in teaching and learning activities.

Your involvement in the study will require participating in a single interview to learn how the University prepares preservice teachers to integrate ICT in teaching and learning. I will ask questions about various University policies that contribute this goal and ask you submit various related documents that reference such policies. The total time commitment for your participation in this study is approximately one hour.

Should you be interested in participating, please refer to the Letter of Information and provide me with an email address so I can contact you with further details.

Sincerely,

Robert Horgan
Doctoral Candidate
Faculty of Education, Queen's University
Research Assistant Name: ___________________________________________________

I acknowledge that I have been retained as a Research Assistant concerning the research project, Preparing Preservice Teachers to Integrate Information and Communication Technology in Teaching and Learning, being conducted by Robert Horgan (the Researcher). In my role as a Research Assistant for the researcher, I understand the nature of the study and requirements for confidentiality. I have had all of my questions concerning the nature of the study and my role as a Research Assistant answered to my satisfaction.

Maintaining Confidentiality
I agree not to reveal in any way to any person other than the researcher any data gathered for the study by means of my services as a Research Assistant. Upon termination of my work I will return to the Researcher all documents and materials related to the research and destroy all electronic files.

This agreement is to be effective upon the date of signing, and shall be interpreted and construed in accordance with laws of the Province of Ontario, Canada.

By: _________________________________

Dated at _______________ this _______ day of ______________, 2010.

Witness: ___________________________________

Please retain a copy of this agreement for your records and provide one to the Researcher.