EXAMINING THE IMPACT OF A HUMAN-TECH FRAMEWORK FOR
UNDERSTANDING TECHNOLOGY INTEGRATION
IN TEACHER EDUCATION

by

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Examining the Impact of a Human-Tech Framework for Understanding Technology Integration in Teacher Education

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ABSTRACT

This research examines on the importance of considering context as design criteria for technology integration and technology design, and in particular, what that means for teacher education. While others (Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004) have broadly considered context as a factor in supporting technology integration, this current research uses a Human-Tech framework (Vicente, 2003) to identify and examine the implications of individual contextual constraints for the design of technology-enhanced learning; therefore, the researcher begins to answer the important - and arguably unexplored - question of how the complexities of varying contexts ought to be used to inform design.

Broadly, this design research study explores the impact of using a Human-Tech framework for understanding technology integration in education and specifically, to inform the design of technology-enhanced learning practices in the context of teacher education. Further, the research reports on the impact of an open online research support forum - designed using a Human-Tech framework - on the experiences of teacher candidates while carrying out classroom-based research as part of their initial teacher education program.

Overall, results of the research study suggest that using a Human-Tech framework for understanding technology integration was helpful in supporting a broader and more
systematic approach to designing for more effective use of technology in the context of teacher education. In terms of the design of the open online research support forum, findings suggest that there were key Organizational constraints that likely continued to have a limiting impact on the innovations across the two-year design study. Therefore, this research also points to future technology-specific and non technology-specific design strategies which may have implications for technology integration, and fulfilling the functional purposes of the program more broadly.
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could do it before I did! A special note to my mom, who raised me on her own - words
can’t really express the gratitude of a child to their parent, but I wanted to say thank you
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Table of Contents

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

ACKNOWLEDGEMENTS..................................................................................................................... iv

DEDICATION ......................................................................................................................................... ix

CHAPTER ONE: INTRODUCTION ........................................................................................................ 1
  Purpose of the Study .......................................................................................................................... 2
  Overview of the Study ...................................................................................................................... 3
  Background to the Study .................................................................................................................. 5
  Research Goal .................................................................................................................................. 8
  Significance of the Study ................................................................................................................ 10
  Background of the Researcher ......................................................................................................... 11
  Definition of Terms: Affordances and Constraints ....................................................................... 13

CHAPTER TWO: LITERATURE REVIEW ............................................................................................. 17
  Introduction ....................................................................................................................................... 17
  Technology’s Role in Teaching and Teacher Education .................................................................. 19
  Models of Technology Innovation and Integration in the Context of Education ....................... 29
  Understanding Technology Innovation and Integration through Design Research .................... 51
  Summary ........................................................................................................................................... 69

CHAPTER THREE: METHOD ............................................................................................................... 72
  Timeline of the Study ...................................................................................................................... 72
  Design Research ............................................................................................................................. 78
  Research Context ............................................................................................................................ 81
  Participants ....................................................................................................................................... 86
  Data Collection and Analysis ......................................................................................................... 89
  The Cognitive Work Analysis ......................................................................................................... 90
  The Design Study ........................................................................................................................... 98
  Summary ......................................................................................................................................... 102

CHAPTER FOUR: RESULTS OF THE COGNITIVE WORK ANALYSIS ............................................ 104
  Research Questions Guiding the CWA .......................................................................................... 104
  Overall Results of the Human Factors Constraint Analysis ....................................................... 105
  Design Implications of the Human Factors Constraints ............................................................. 110
  Innovation 1: The Online Research Mentorship (ORM) ............................................................... 112
  Summary ......................................................................................................................................... 118

CHAPTER FIVE: RESULTS OF INNOVATION 1 .................................................................................. 120
  Research Questions Guiding Innovation 1 ..................................................................................... 120
  Use of the Open Online Research Support Forum (ORM) ............................................................ 121
  Impact of the ORM on Collaboration around the Student Research ............................................ 128
  Students’ Perceived Impact of the ORM ....................................................................................... 141
Mentor Feedback on the ORM ................................................................. 158
Emergent Constraints Identified During the Design Study .................. 161
Summary .............................................................................................. 167

CHAPTER SIX: RESULTS OF INNOVATION 2 ........................................ 169
(Re-)Design Implications of the Human Factors Constraints ................ 169
Research Questions Guiding Innovation 2 ............................................ 173
Use of the Student Online Research Support Centre (SORSC) ...... 173
Impact of SORSC on Collaboration around the Student Research .... 179
Students’ Perceived Impact of the SORSC ........................................ 183
Summary .............................................................................................. 190

CHAPTER SEVEN: CONCLUSIONS AND IMPLICATIONS ...................... 194
Summary of the Contributions of the Research ................................. 194
Expanding on the Local Research Implications ................................. 199
Expanding on the Broader Research Implications .............................. 206
Summary .............................................................................................. 210

REFERENCES ....................................................................................... 212

LIST OF TABLES
Table 1 Levels of Use of an Innovation (Hord et al., 1987) ...................... 41
Table 2 Timeline of the Research ......................................................... 73
Table 3 Participation in Phase 2 and 3 of the Research ....................... 87
Table 4 Description of Data Sources Gathered during the Research .... 89
Table 5 Summary of Human Factor Constraints Identified in the MA-T Program .......................... 106
Table 6 Creswell’s (2008) Steps in Conducting Research (SCR) .............. 123
Table 7 Summary of Participation (Contributions and Notes Read) in the ORM ........................................ 125
Table 8.1 Activity in Yelena’s Online Research Group ......................... 130
Table 8.2 Activity in Emma’s Online Research Group .......................... 132
Table 8.3 Activity in Mark’s Online Research Group ......................... 133
Table 8.4 Activity in Kim’s Online Research Group ............................ 134
Table 8.5 Activity in Monica’s Online Research Group ...................... 136
Table 8.6 Activity in Elaine’s Online Research Group ......................... 137
Table 9 Student Feedback on the ORM .............................................. 143
Table 10 Summary of Student Participation in Innovation 2 of the Design Study ........................................ 184
Table 11 Student Feedback Regarding the MA-T Program and the Research Projects .......................... 185
Table 12 Student Feedback on the Online Reflection Journals (Psychology Course) ... 186

LIST OF FIGURES
Figure 1. Koehler & Mishra’s (2008) TPCK Model ............................... 32
Figure 2. Vicente’s Human-Tech Ladder .............................................. 63
Figure 3. A Prototypical Design Research Cycle .................................. 79
LIST OF APPENDICES

APPENDIX A: Student Consent Letter, 2006-2007 .......................................................... 219
APPENDIX B: Faculty Consent Letter, 2006-2007 .......................................................... 221
APPENDIX C: Mentor Consent, 2006-2007 ................................................................. 223
APPENDIX D: Student Consent Letter, 2007-2008 ....................................................... 225
APPENDIX E: Cognitive Work Analysis, Student Interview ........................................... 227
APPENDIX F: Cognitive Work Analysis, Faculty Interview ........................................... 229
APPENDIX G: Student Pre-Survey, 2006-2007 ........................................................... 231
APPENDIX H: Student Pre-Survey, 2007-2008 ............................................................ 238
APPENDIX I: Faculty Survey, 2006-2007 ....................................................................... 249
APPENDIX J: Transcriber Confidentiality Agreement ....................................................... 255
APPENDIX K: Rater Training Manual ............................................................................ 256
APPENDIX L: Practice Coding Table ............................................................................ 258
APPENDIX M: End of Year Student Survey 2006-2007 ................................................ 259
APPENDIX O: Pre-Survey, Mentors 2006-2007 .......................................................... 293
APPENDIX P: End of Year Survey, Mentors 2006-2007 ............................................... 297
APPENDIX Q: Constraints Addressed in Innovation 1 of the Design Study .................... 303
APPENDIX R: Examples of Student Notes from the ORM ............................................. 312
APPENDIX S: Constraints Addressed in Innovation 2 of the Design Study .................... 336
APPENDIX T: Examples of Student Notes from the SORSC ......................................... 345
DEDICATION

This thesis is dedicated in memory of:

My loving grandparents,
Margaret and Jack Phillips, and
Malcolm MacKinnon

and

My father-in-law, Hugh Doherty.
CHAPTER ONE: INTRODUCTION

Although it is generally understood that technology has the potential to support teaching and learning, and also improve the way that teaching and learning happens (Cambre & Hawkes, 2004) many argue that there has been little evidence of ubiquitous access and use of technology (Norris, Sullivan, Poirot & Soloway, 2003), benefits to learning and/or changes to existing practices in education (Cuban, 2001; 1986; Klopfer, 2008). Furthermore, despite the fact that “fluent use of new technologies is now a societal goal for curriculum” (Darling-Hammond, Banks, Zumwalt, Gomez, Sherin et al., 2005, p. 187), and there are expectations now incumbent on teachers (and teacher educators) to integrate technology into teaching and learning in meaningful ways (International Society for Technology in Education, 2008), teacher education programs continue to struggle with the problem of creating and sustaining effective technology integration, and have encountered many barriers towards facilitating teacher professional development in the area of technology-enhanced learning (Finley & Hartman, 2004). Bransford, Darling-Hammond and LePage (2005) provide an overview of literature on teacher professional development that suggests that the quality of teacher practice is in many ways attributable to the quality of a teacher’s initial pre-service preparation. Therefore, it is foreseeable that problems with effective technology integration in teacher education, is likely to have an impact on the ways technology is ultimately used - or not used - to support learning in K to 12 schools.

The researcher argues that current frameworks for understanding technology integration, in particular for guiding teacher education, have failed to make progress on problems associated with effective use of technology in support of learning, and have
neglected to take into account such important contextual factors as design criteria in shaping technological affordances for learning. Others have suggested the importance of context in understanding how to leverage new and emerging technologies to support learning (Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004), and this research provides some insight in beginning to explore how individual contextual factors might influence design.

**Purpose of the Study**

Current problems in education - both K to 12 and teacher education - with creating and sustaining effective use of technology in support of learning provided the main impetus for this research. Following a design research methodology (Bereiter 2002a; Brown, 1992; Collins, 1992; 1999; Edelson, 2002; Woodruff & Nirula, 2005), the researcher explores the impact of using a Human-Tech framework (Vicente, 2003) for understanding technology integration in education and specifically, to inform the design of technology-enhanced learning practices in the context of teacher education. Further to this, the research study reports on the impact of an open online research support forum - designed using a Human-Tech framework - on the experiences of teacher candidates while carrying out classroom-based research as part of their initial teacher education program. The goal of this research is twofold: 1) to explore the potential of using a Human-Tech framework for understanding technology integration in the context of teacher education and, 2) to examine the impact of a socio-technical tool (the open online research support forum) that was designed using a Human-Tech framework. As part of the first goal of the study, the researcher explores the potential of using a Human-Tech
framework through the implementation of a modified version of a technology design tool called Cognitive Work Analysis (CWA) (Vicente, 1999). Although CWA is a focus within this study, the researcher wishes to emphasize its role as a vehicle to understanding the more general utility of a Human-Tech framework for technology integration and technology design, rather than speculating on its relative importance as a particular method for technology design in the context of education.

**Overview of the Study**

The bulk of this research study took place over a two-year period, beginning in June 2006, although work contributing to the study began in September 2005. Data were collected from two separate cohorts of students enrolled in a two-year graduate level teacher education program, focused on curriculum and teaching (MA-T) (2006-2007 and 2007-2008), as well as members of the core faculty involved in the program during both years. In addition to traditional stages of design research (Bereiter 2002a; Brown, 1992; Collins, 1992; 1999; Edelson, 2002; Woodruff & Nirula, 2005), this study also integrates new procedures associated with a Human-Tech framework (Vicente, 2003) for technology integration through the implementation of a modified Cognitive Work Analysis (Vicente, 1999). An open online discussion forum called Knowledge Forum® is the main technology used in the study, since it is a relatively malleable platform which leaves the user some degrees of freedom in how to set up various aspects of the interface, allowing for certain customizable features to be used to suit particular purposes. Knowledge Forum® also comes with a data analysis function (Analytic Toolkit) that allows the researcher to run various queries on user activity to support findings in the
The main goal of the study is twofold: 1) to explore the potential of using a Human-Tech framework for understanding technology integration in the context of teacher education and, 2) to examine the impact of a socio-technical tool (the open online research support forum) that was designed using a Human-Tech framework. The overall objective of the open online research support forum is to support the MA-T students in carrying out their major research projects as part of their initial teacher education program. Data from the modified Cognitive Work Analysis is used to inform three underlying objectives for supporting the students’ research, and for designing the open online research support forum: 1) to provide personal, ongoing assistance to students while carrying out their research, 2) to encourage students to actively work on and discuss their research throughout the year and, 3) to encourage students to collaborate with others - in particular, their peers - around their research topics. In this study collaboration is defined around three key principles of knowledge building - a) idea diversity, b) community knowledge, collective responsibility, and c) symmetric knowledge advancement (Scardamalia, 2002).

The results of this study are reported in three main sections: 1) results from the modified Cognitive Work Analysis and discussion of their implications for socio-technical design in the context of the MA-T program (Chapter 4), 2) results from Innovation 1 in which an online research mentorship is implemented based on a human constraint analysis formed through the modified Cognitive Work Analysis (Chapter 5), and 3) results from Innovation 2 in which an online research support centre is implemented based on the same constraint analysis, with the addition of two emergent constraints which were revealed during Innovation 1 (Chapter 6).
**Background to the Study**

The current research grew out of a pilot study carried out during the 2005-2006 academic year, in another two-year teacher education program, in which the researcher was examining the impact of using information communication technology (ICT) on teacher candidates’ views of ICT and its role in supporting constructivist approaches to teaching and learning. In particular, the researcher wanted to know how the experiences teacher candidates have with different types of ICT (e.g., online discussion forums, handheld computers equipped with infrared and Wifi communication) during their initial teacher preparation programs might influence their beliefs about the role of ICT in supporting teaching and learning for their own practice.

Towards the end of the study, the researcher was left with very little information to explain some unanticipated results in which marked differences were noted in students’ levels of participation in an online discussion forum, a sudden drop in students’ use of the online discussion forum, and a seeming lack of interest in taking advantage of opportunities to learn to use a new technology. Predicting that it would be difficult to measure shifts in students’ beliefs about the role of ICT in supporting teaching and learning since many of the students were never fully involved in using the ICT, the researcher decided to re-direct the goal of the study towards understanding why the technology had seemed to fail in fully supporting students’ learning. In order to inquire further, the researcher interviewed a selection of the students to gather feedback on their experiences using ICTs as part of their course.
What became clear through the interviews was that there was a number of elements of the socio-technical learning environment that were likely having an impact on, or constraining, students’ experiences with using ICTs - in particular, an open online discussion forum (Knowledge Forum®) and Wifi-enabled handheld computers used to connect to the Knowledge Forum® in class. Some of these constraints were technological in nature. For example, one student mentioned the fact that she did a lot of her work outside of Knowledge Forum® - in Microsoft™ Word - so that she could use the Spell Check function before contributing her notes. Although this student could also have elected to ‘edit’ her note if she noticed an error, it also suggests that the addition of a Spell Check function in Knowledge Forum® might reduce the tendency for some students to work around the online forum. Other students mentioned that the small screen and the stylus as an inputting device for the handheld computers were limiting and difficult to use, especially since much of the work in Knowledge Forum® involves typing notes.

Another constraint that became apparent through the interviews was pedagogical issues. For example, one student mentioned that he thought a hundred and fifty word format for writing notes in Knowledge Forum® was too short and not enough space to create the kind of written argument that might lead to a shift in his understanding, such as what one might do when writing a longer essay. It should be noted that there was no technological reason (such as a space limit) why the notes in Knowledge Forum® were often no more than a hundred and fifty words in length. However, the students as a class at the beginning of the year - along with the instructor and the researcher - had agreed that shorter, more succinct notes would be more likely to maintain an informal,
conversational exchange in the online discussion. Furthermore, Hewitt & Brett (2007) showed that increased length of online notes can encourage ‘scan reading’ as opposed to careful reading. This suggests that keeping the length of the notes shorter could be an effective strategy to encourage more meaningful online participation. However, what became evident from this particular student’s perspective was that this pedagogical decision to keep the notes short, also may have constrained the type of contributions students were willing to make to the class online discussion - and in this case, the perceived value of the online discourse for learning was decreased.

There were also psychological constraints that became apparent through the interviews, such as comments about the tendency to want to ‘stick to what you know’, and keep to old ways of doing things that are most familiar. One student also mentioned the feeling of being ‘slowed down’ by new and unfamiliar technology because she had to learn how it worked, and the perception that every computer “has a language of its own you have to figure out”. Also, all of the students mention initial feelings of apprehension towards using the Knowledge Forum®, although all except one claim that they changed their perceptions over time and began to think more positively about it.

Lastly, the student interviews suggested that there are some higher level constraints associated with the two-year graduate level teacher education program itself. All of the students mentioned that the program is very busy, and that they have very little time to carry out all that is expected of them. This seemed to have an impact on the discussion in Knowledge Forum® since it limited time available for students to engage in ongoing conversations. While it seems - as one student pointed out - that some of the students appreciated “being able to see and then read about what other people were
thinking and going through” in the Knowledge Forum®, for some other students
discussion never got beyond feeling like homework.

What the pilot study seemed to suggest was that there was not one, single reason
that could explain unanticipated results in which marked differences were noted in
students’ levels of participation in an online discussion forum, a sudden drop in students’
use of the online discussion forum, and a seeming lack of interest in taking advantage of
opportunities to learn to use a new technology. It appeared that there were a number of
contextual factors that could have potentially lead to the negative outcomes of the pilot
study - factors that could potentially have been used to inform more effective use of ICT
in the program, had they been identified earlier.

In the current study, the researcher explores the potential of a Human-Tech
framework for understanding technology integration through the implementation of a
modified technology design tool called Cognitive Work Analysis (Vicente, 1999), which
“directly supports the creation of technological solutions that are informed by the unique
attributes of the human systems in which they are meant to be used” (MacKinnon &
Woodruff, 2008a). Therefore, the researcher continued to examine technology
integration within the context of a two-year model of teacher education, although this
time, through the lens of a Human-Tech framework.

**Research Goal**

The goal of this research is twofold: 1) to explore the potential of using a Human-
Tech framework for understanding technology integration in the context of teacher
education and, 2) to examine the impact of a socio-technical tool (an open online research
support forum) that was designed using a Human-Tech framework. As part of the first goal of the study, the researcher explores the potential of using a Human-Tech framework through the implementation of a modified version of a technology design tool called Cognitive Work Analysis (CWA) (Vicente, 1999). Although CWA is a focus within this study, the researcher wishes to emphasize its role as a vehicle to understanding the more general utility of a Human-Tech framework for technology integration and technology design, rather than speculating on its relative importance as a particular method for technology design in the context of education.

The overall objective of the open online research support forum is to support graduate level teacher education students (MA-T) in carrying out their major research projects as part of their initial teacher education program. Data from the modified Cognitive Work Analysis is used to inform three underlying objectives for supporting the students’ research, and for designing the open online research support forum: 1) to provide personal, ongoing assistance to students while carrying out their research, 2) to encourage students to actively work on and discuss their research throughout the year and, 3) to encourage students to collaborate with others - in particular, their peers - around their research topics. The central research question in the design study asks: What is the impact of a Human-Tech approach to technology integration and technology design on supporting student research in the context of a two-year teacher education program?

Research Questions

Specifically, the questions examined in this study include:
Question One

What does a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, reveal about the system constraints of a two-year graduate level teacher education program?

Question Two

What are the technological design implications of a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, for supporting student research in the context of a two-year graduate level teacher education program?

Question Three

What is the impact of an open online research support forum, designed using a Human-Tech framework for technology integration, on students’ experiences in carrying out research as part of their initial teacher preparation in the context of a two-year graduate level teacher education program?

Significance of the Study

This research expands on the importance of considering context as design criteria for technology integration and technology design. While others have broadly considered context as a factor in supporting technology integration, this current research uses a Human-Tech framework to identify and examine the implications of individual contextual constraints for the design of technology-enhanced learning; therefore, the researcher begins to answer the important - and arguably unexplored - question of how
context ought to be used to inform design. This work has three main implications: 1) generally, to lend further support to the claim that there is a need for better ways of identifying and examining the implications of contextual factors for technology design and integration in educational contexts, 2) to demonstrate the ways in which a constraint-based framework could support a design research methodology (Bereiter 2002a; Brown, 1992; Collins, 1992; 1999; Edelson, 2002; Woodruff & Nirula, 2005) involving socio-technical innovation in a teacher education context, and 3) specifically, to explore the outcomes of the implementation of a constraint-based approach to technology integration in a teacher education context, in which a particular system need has been identified - in this case, to support classroom-based research in the context of an extended two-year teacher education program.

**Background of the Researcher**

Since beginning the journey of my doctoral studies six years ago, my research has taken more of a winding path, than a straight and narrow one. My desire to focus my research in the context of teacher education came as a result of my Master’s thesis in which I explored the use of participatory simulations (handheld technology) in supporting learning in secondary level Science (MacKinnon, 2003). This was at a time when handheld computers did not have quite the level of ubiquity that they now have in North America - and most K to 12 schools did not have them - however, the majority of schools had access to desktop computers and the Internet (although the distribution often varied from school to school). During this time, I got to know many teachers who were either teaching in K to 12 schools, or had taken temporary leave from their teaching to attend
graduate school. Many of them mentioned their amazement about how different their students’ learning experiences are from their own learning experiences in K to 12, and even their post-secondary education, with respect to technology. A large number of them had had minimal experience with technology, especially in the context of teaching and learning. I then began to wonder what the real impact of technology would be for education, if the teachers had minimal experience with technology and more importantly, little first-hand knowledge of what it is like to learn with technology through their own educational experiences. So, I began my dissertation research by investigating the impact of integrating various kinds of information communication technology (ICT) in teacher education, on teacher candidates’ beliefs about the role of technology in teaching and learning.

It became apparent very early on, that integrating ICT in the context of teacher education was not going to be as easy as it was with the K to 12 students in my Master’s research (I also tested out the participatory simulations in younger grades). Furthermore, in reading research about technology in education, I became impatient with theories that suggested an apathetic culture among teachers towards technology. This was not what my data suggested about the teacher candidates in my pilot study - they used technology on a regular basis, and they recognized the importance of considering the role of technology in learning. But my efforts to support their own learning through the use of ICT were minimally successful at best. I wanted to know why it was that even when the content, the pedagogy and the technology (Koehler & Mishra, 2008) was taken into account in the design, and the students were - for the most part - capable of learning with, and eager to learn about, technology in the context of teaching and learning, the socio-technical
system was still failing to thrive. What I learned through the process of my study was that the way you perceive the problem of technology integration - right from the start - will have an impact on what you ultimately focus your attention on in determining how to go about designing socio-technical learning environments; and subsequently on the outcomes of that design. Furthermore, as I will elaborate in the next chapter, current models of understanding technology integration in the context of education typically focus on only a very small portion of the overall learning system, leaving a lot of potentially vital information about the design context ‘out of focus’, or out of the picture altogether.

**Definition of Terms: Affordances and Constraints**

Throughout this document, the researcher often uses the term “constraint”. There are many implicit meanings of this term - such as, that it is the opposite of “afford” - and therefore, the researcher wishes to make it clear how the term is being used hereon in. The following definitions of “afford”, “constrain” and “constraint” come from the Merriam-Webster online dictionary (available: http://www.merriam-webster.com/dictionary/):

**Afford:**

“to make available, give forth, or provide naturally or inevitably <the sun affords warmth to the earth> <the roof afforded a fine view>”.

**Constrain:**

“1 a: to force by imposed stricture, restriction, or limitation b: to restrict the motion of (a mechanical body) to a particular mode, 2: compress; also : to clasp tightly, 3: to secure by or as if by bonds : confine; broadly : limit, 4: to force or produce in an unnatural or strained manner <a constrained smile>, 5: to hold back by or as if by force <constraining my mind not to wander from the task — Charles Dickens>”.
Constraint:

“1 a: the act of constraining, b: the state of being checked, restricted, or compelled to avoid or perform some action <the constraint and monotony of a monastic life — Matthew Arnold>, c: a constraining condition, agency, or force: check <put legal constraints on the board's activities>, 2 a: repression of one's own feelings, behavior, or actions, b: a sense of being constrained: embarrassment”.

These definitions do not contradict the common understanding that a constraint is the opposite of an affordance. The juxtaposition of these terms also suggests that an affordance is positive, while a constraint is something negative.

The researcher makes a case throughout this document for a view of technology-enhanced learning and technology integration that takes into account measures of affordances and constraints. The researcher argues that one cannot really understand effective use of technology for learning without thinking about affordances, and affordances cannot really be measured without thinking about constraints associated with the learning context. Essentially, the point the researcher is making is that constraints help to define - and even shape - what technological affordances ought to look like.

Gibson (1986) wrote about the concept of an affordance, suggesting that it is distinct from the term ‘afford’. According to Gibson, any medium, substance, surface, object, etc. can afford certain things but its affordance depends on an actor - someone or something taking action - in relation to it. In other words, an affordance “implies the complementarity of the animal and the environment” (p. 127).

For example, a stick may serve as a bridge, affording the ability to cross from one side of a river bank to another. However, the stick being small and brittle may only serve as an affordance to a small creature like an ant or a squirrel, not a human being that is relatively heavy and likely to break the stick upon standing on it. In other words, the stick
is an affordance to the ant or the squirrel, but not the human. Norman (1988) also believed that the affordance of a particular tool depends on an actor that is taking some kind of action. However, for Norman the affordance of the tool also depends on the actor’s perception of the object in relation to a desired goal.

Vicente (2003) would agree with Gibson and Norman that affordances represent an interactional relationship between people and technology, which Vicente calls a “Human-Tech” relationship. Furthermore, Vicente would also agree with Norman that technology ought to be designed to take into account what we know about human behaviour (or action), so as to increase the likelihood that particular goals can be accomplished. However, Vicente also suggests that interactions between humans and technology often take place in complex settings (such as work environments) and therefore, behaviour needs to be considered in terms of increasingly complex social factors - or what Vicente calls “constraints”. In other words, action is not simply a matter of individual perception, but it is also a matter of social structures that are embedded within the particular setting in which action is taking place. Therefore, design needs to take into account not only what actions a person is likely to carry out in relation to a particular goal, but also what actions are likely to be carried out within a complex system in which there are multiple actors, shifting conditions and perhaps even multiple or overlapping goals.

In summary, the researcher wishes to clarify for the purposes of this research that the term ‘constraints’ is not meant to be the opposite of an affordance. A Human-Tech framework suggests that a constraint can also help determine what is likely to become an affordance within a given system, since action (or behaviour) is defined by constraints.
Constraints are defined by human factors - and Vicente would stress: not just individual, cognitive factors. Furthermore, it is important to note that constraints may take the form of a barrier on action (the more common deficit or restrictive framework mentioned earlier), but they can also take the form of criteria for action (a design framework). In other words, the constraints are the affordances in so far as they help to determine what is likely to guide goal-directed behaviour in a particular context.

In the following chapter, the researcher presents some of the more popular frameworks of technology integration currently referenced in education, which - the researcher argues - primarily focus on individual, cognitive factors in guiding technology-enhanced learning (rather than the full extant of human factors, as Vicente suggests is important) and also tend to emphasize a deficit model of design constraints. The researcher suggests that this is a narrow perspective to take on technology integration and technology design, and that a Human-Tech framework points towards a new, broader way of thinking for those interested in technological affordances for learning.
CHAPTER TWO: LITERATURE REVIEW

Introduction

The purpose of this study is to explore the impact of a Human-Tech (Vicente, 2003) approach to technology innovation and integration on supporting student research in the context of a two-year teacher education program. The goal of this research is twofold: 1) to explore the potential of using a Human-Tech framework for understanding technology integration in the context of teacher education and, 2) to examine the impact of a socio-technical tool (an open online research support forum) that was designed using a Human-Tech framework. This study draws on a wide array of literature including the current role of technology in education, models of technology integration in the context of education, and the implications of a Human-Tech model of technology integration as a new theoretical framework for understanding technology-enhanced learning.

At the time that this study was implemented, there were no generally-accepted ways of carrying out design research in an educational context that would allow researchers to take all the complexities of the socio-technical learning environment into account in a systematic and rigorous way. Therefore, this study also integrates newly added features to the process of carrying out design research in the context of teacher education through the use of a modified approach to Cognitive Work Analysis. The particular methodological implications of Cognitive Work Analysis for design research involving socio-technical learning environments will be discussed in the next chapter (Method).

This chapter begins by examining the current role and status that technology plays in education, with particular reference to technology-enhanced learning in teacher education. Second, the researcher will explore existing frameworks for understanding
technology integration in education, and their implications for understanding technology-enhanced learning in teacher education. Third, the researcher will describe the current role of design research in discovering ways to effectively integrate technology into learning, as well as its limitations as a tool for collecting and organizing information about learning context. The chapter then concludes with a look at a Human-Tech (Vicente, 2003) framework for technology integration and technology design, supported through the use of a modified design tool called Cognitive Work Analysis (Vicente, 1999) to uncover and organize relevant contextual information that may have implications for design.

The central argument the researcher makes in this chapter is that, currently, theoretical and methodological frameworks for understanding technology integration in teacher education are limited in that they take into account very little about the complexities of the learning context as technological design criteria. Existing models of technology integration in education focus almost exclusively on the cognitive attributes of education stakeholders (mainly, teachers and students), typically at the level of individual knowledge, competencies and acceptance. Furthermore, design research as a tool for investigating ways of supporting technology-enhanced learning is currently limited in its ability to allow the researcher to uncover and use information about the learning context to structure and prioritize design decisions. As such, much about the learning context remains hidden from the researcher, and is left out of the design process. This combination of theoretical perspectives that are confined to cognitive attributes of education stakeholders in supporting frameworks for understanding technology integration, in addition to limited methodological means (of design research) for
examining attributes of the learning context that may be important to design, suggest that recent efforts to support learning through the use of technology have been extremely narrow in focus. This study will show how a Human-Tech (Vicente, 2003) framework for technology integration, supported through the use of Cognitive Work Analysis as a tool to uncover and organize relevant contextual information that may have implications for design, can potentially offer a new - and broader view - of the meaning of technology-enhanced learning for teacher education.

**Technology’s Role in Teaching and Teacher Education**

This section explores the role and status that technology currently plays in education. The researcher begins with a look at the current status of access to technology in K to 12 schools, and teachers’ perceptions of the role of technology in supporting teaching and learning. Next the research will discuss the role that technology is (or is not) playing in teacher education programs, and teacher candidates’ opinions about the use of technology for their own development, as well as its role in supporting teaching and learning. The researcher will show that much of the current research on the impact of technology in education, and in particular teacher education, indicate contextual factors that potentially play a mediating role in outcomes of studies. However, the researcher also argues that these studies may be pointing to the need for research that takes context into account as part of socio-technical design (design constraints), rather than treating it as a series of confounding variables after the fact (barrier constraints).
Technology’s Role in K to 12 Education

Over the past two decades, availability of computer hardware and software in households, workplaces and schools has risen. According to Kirkwood and Price (2005), computer access rose by 31% in the UK between 1988 and 2001. They also report that access to the Internet in UK households rose by 34% in the span of four years, between 1998 and 2002.

Access to computers and the Internet within schools has also risen dramatically; as of 1998, 90% of schools in the United States had at least some access to the Internet (Becker, 1999). In 2003, Statistics Canada and Industry Canada conducted a national Information and Communications Technologies in Schools Survey (ICTSS) to measure current infrastructure related to ICT in schools (Plante & Beattie, 2004). This report estimated that “more than one million computers were available for educational use in schools across the country” (p. 8), or an average of approximately 72 computers per school. Furthermore, they report that the current student-to-Internet-connected-computer ratio in Canada is 5 to 1, with elementary schools showing a slightly higher average of 6 to 1 than secondary schools which report an average of 4.6 to 1. A report commissioned by the Canadian Education Statistics Council, indicates that 97% of youth in schools had used a computer in the last 12 months, with 58% of males and 45% of females reporting that they use a computer every day at home (Looker & Theissen, 2003). Moreover, according to the ICTSS survey (Plante & Beattie, 2004) the majority of school principals (92% or higher), agreed that “ICT is worth the investment”, “ICT allows teachers to broaden and enrich the curriculum”, “ICT enables the curriculum to be more challenging
and enriching” and “ICT enables students to go beyond the prescribed curriculum, thereby facilitating an increased knowledge base” (p. 28).

Subsequent to these relatively positive reports on the views of school administration and on physical access to technology in schools, concerns about technology integration have now shifted towards looking at how technology is actually being used; and in this respect, the results are less encouraging. Despite improvements in access to technology, it’s not clear that there has been a significant and wide-spread impact on use or the ways that teaching and learning are carried out in schools (Cuban, 2001; 1986; Klopfer, 2008; Norris, Sullivan, Poirot & Soloway, 2003). According to the ICTSS survey (Plante & Beattie, 2004), less than half (46%) of school principals report that more than 75% of their teachers have the skills to engage students in technology-enhanced learning, and 40% report that access to training opportunities for teachers represents one of the challenges to ICT use in their school. Principals also reported that teachers tended to use ICT mainly for word processing activities (78%), whereas substantially fewer report the use of ICT for things like programming for special needs students and/or individualized learning (29%), or for online learning (29%). Furthermore, two thirds of principals reported that funding for technology was a problem, and close to 40% mentioned that sufficient number of computers was still a concern.

There is a substantial volume of educational research dedicated to examining the factors that contribute to a teacher’s decision to integrate technology into their teaching. According to Churchill (2006), teachers’ private theories about technology integration can have an influence on the kinds of technology-based lessons they implement. Churchill reports that teachers’ private theories tend to reflect prior experience and
beliefs about students, learning, the role of the teacher, technology, design of lessons, and the broader societal changes that impact education. Churchill concluded that when teachers’ private theories were dominated by concerns that focused on learning, as opposed to the other domains, they were more likely to incorporate student-centered technology-based learning whereas, when their private theories were dominated by concerns that focused on students, technology or the role of the teacher, they tended to incorporate a direct instruction model of technology-based learning. Sugar, Crawley and Fine (2004) suggest that teachers’ decisions to adopt technology into their teaching rests primarily on “teachers’ conscious reasoning about the personal consequences for doing so” (p. 211). Others, such as Ross, Hogaboam-Gray and Hannay (1999) suggest that teacher efficacy plays an important role in determining whether they use technology in their teaching, and that the most important predictor of confidence with technology-enhanced learning relates to teachers’ perceptions of their ability to use computers (personal computing skills). However, Bauer and Kenton (2005) suggest that even the most technologically savvy teachers do not necessarily “integrate technology on a consistent basis” (p. 519) and they cite obstacles such as, access to available of hardware, time to plan technology-enhanced lessons, student skill levels, and technical problems as issues that might impede a teacher’s use of technology. Franklin (2007) similarly indicated that for teachers who felt well prepared during their teacher preparation program to use technology in their teaching, it was still unclear what impact this had on their actual classroom practice. Sime and Priestley (2005), who conducted a study in which teacher candidates were asked to reflect on their experiences with integrating ICT
into teaching during their practicum settings, suggest one possible reason for the lack of wide-spread use of ICT in schools is that:

As student teachers were taught in their course ways of integrating ICT in teaching subjects, many of them found themselves in between two cultures: the culture of the teacher training course that underlies the importance of ICT as a teaching tool in all subjects, and the culture of the schools where they had to work and which still tends to perceive ICT as a separate subject (p. 139).

It is not uncommon in the literature on teacher use of technology in teaching to see conclusions which indicate that contextual barriers play a significant role in limiting the use of technology, even when teachers’ prior experience with technology, training and attitudes have been taken into account (Franklin, 2007; Friedman, 2006). What this seems to suggest is that, while the attributes of the teachers themselves may play a role in shaping how (and how much) technology is used in teaching, it is also likely that there are other attributes associated with the educational contexts that are playing a mediating factor.

**Technology’s Role in Teacher Education**

According to Beyerbach, Walsh and Vannatta (2001) a fully integrated approach to the use of technology in teacher education - where technology is integrated into all aspects of the program including coursework and practicum - can have positive impact on teachers’ attitudes and views about technology as a tool for supporting teaching and learning. However, the integration of technology into the education of teachers shares a similar story with K to 12 education; though the technology is present, there has been little noticeable effect of change to the way that teaching and learning happens (Miller, Martineau & Clark, 2000). Kirkwood and Price (2005) make a similar claim that for
post-secondary learning, “ICT has been introduced into higher education largely as a supplement to existing teaching and learning practices” (259). Finley and Hartman (2004) write about this difficulty with technology integration specifically in the context of teacher education, and suggest that there are many barriers to consider such as: lack of adequate instructor training, institutional norms that constrain change (also lack of norms that provide support or incentive), the need to connect the use of technology to content objectives, and the need for consistency between teaching style and the form and use of technology.

There are many examples of studies that report on the integration of technology in the context of teacher education, however, one of the largest projects to date has been the Preparing Tomorrow’s Teachers for Technology (PT3) initiative, supported by the US Department of Education. “Since 1999, PT3 has awarded over 400 grants to education consortia” (U.S. Department of Education, 2006, Preparing Tomorrow’s Teachers to Use Technology Program) for projects that were designed to improve teachers’ preparedness to use technology in their teaching. Numerous publications regarding technology integration in teacher education have grown from this initiative. Although it wouldn’t be feasible to report on all 400 projects, a few are described below.

**Impact of Technology Integration on Teacher Candidates’ Beliefs**

Mullen (2001) reports the results of a PT3 project that focused on examining how teacher candidates’ “beliefs about teaching and learning influence, change, mediate and transform the understandings of the role of computer for teaching and learning?” (p. 450). In this project, four students were followed by the researcher for one academic year to see how their beliefs were changing as a result of their experiences in the program; each
student was interviewed once a month. The researcher described that the teacher education program in which the students were enrolled has adopted an infusion model for technology integration (i.e., including technology within courses, as opposed to a stand-alone course) however, there are some courses that still do not include technological component. The results of this study suggest that for some students beliefs about the role of the teacher can be somewhat changed by their experiences within a program in which technology infusion is at least partially apparent, though not ubiquitous. However, the authors also mention that the impact can vary for different students (i.e., some remain seemingly unaffected). The authors mention at the end of their study that a movement towards technological literacy as a required component of teacher licensure may lead to some progress towards developing technological competencies however, they also caution the need to have appropriate assessment criteria and qualified evaluators (i.e., a background and experience with technology) for standardization to succeed.

**Impact of Faculty Development on Technology Integration**

Brzycki and Dudt (2005) present their work on a PT3 project targeting various types of faculty development, and the creation of university-school partnerships geared towards technology infusion in the context of teacher education. Their study consisted of four parts (or goals): 1) provision of various faculty workshops (e.g., short, single technology workshops and long (2 to 5 days) workshops), 2) increasing use of instructional technology during field experiences (practicum), 3) providing “other” kinds of support for faculty and instructors in the form of individual help, classroom mentoring (observation, assistance, and independent application), in-class student assistants, faculty models, teaching circles (faculty, K to 12 teachers and teacher candidates work together
in reflective practice groups), and a repository of instructional materials, and 4) to improve the university’s technological infrastructure through things like cost sharing and increasing awareness and support through university administration. The study ran over three years and involved numerous incentives to encourage stakeholder participation. At the conclusion of the study, the authors report that “This grant confirms that innovation has at least a five-year cycle” and “in spite of progress, many faculty in our teacher education programs were still at an early stage of technology usage after three years of the grant” (p. 636). In the end, the authors cite things like time, accessibility and securing faculty “buy-in” as contextual barriers and concerns that need to be considered.

**Impact of an Online Professional Development Program on Technology Integration**

Rowley, Dysard and Arnold (2005) report the results of a PT3 study in which a partnership was formed between the University of Dayton (UD) and the U.S. Public Broadcasting System (PBS) to allow UD to have free access to approximately 67 online professional development modules (called “TeacherLine”) that had been developed by PBS. These modules are “structured online learning experience[s] focused on a specific technology-enhanced learning topic” (p. 107). Teacher educators were given training on how to use the online modules in addition to stipends in exchange for completing this training and integrating an online module into one of their classes. Also, a selection of student teachers enrolled in the program were hired to examine the use of the modules in the classes and provide feedback on the integration of the modules into the program, and how it could be improved. During the study, a framework was developed to help participants think about the different types of use of the online modules. This framework
divides types of use into three categories: the “supplemental resource” model (online modules are available, but instructor does not align them within course content), the “custom integration” model (some tools associated with the online modules are used and professors create course assignments that integrate the online module and course content) and the “full integration” model (online modules are fully integrated with course content and course goals are congruent with the goals for the online module). Among the outcomes of the study was that only 5% of the faculty adopted a full integration model for the online modules, suggesting that faculty preferred to use the technology to supplement or enhance their existing practices, rather than shift them entirely. Furthermore, student responses to the use of the online modules were not as positive as the faculty responses, however, both students and faculty tended to rate the modules more positively than negatively. The authors conclude their research by noting that factors like technical difficulties, and instructor pedagogies around integration of the modules as areas of concern and further improvement.

**Impact of Field-Based Technology Training on Technology Integration**

The final PT3 project reported here was conducted by Brush, Glazewski, Rutowski, Berg, Stromfors et al. (2003), in which the authors examined the outcomes of providing support for teacher candidates to “develop, implement and evaluate their own instructional activities that utilize technology effectively and appropriately in authentic situations” (p. 59). The students initially participated in observational training in which graduate students and/or placement teachers modelled the use of technology as part of a lesson. Students were then expected to design their own lessons which integrated technology and content. The results of the study suggest that providing modelling and
support for students to design and implement their own technology-based lessons is an effective strategy for helping teacher candidates to develop technological competencies with respect to teaching and learning. However, one of the areas of concern that the authors mention is a lack of sufficient ongoing modelling of technology use by placement teachers and faculty. Although training was provided to placement teachers and faculty formally and informally throughout the study, many did not actually use technology consistently throughout the year, and the authors comment that this could have impacted the outcomes of the study for the student teachers involved.

Aside from the PT3 projects, there have been many other recent studies that report on the use of technology in the context of teacher education including: the use of electronic portfolios (Milman, 2005), multimedia cases (Hewitt, Pedretti, Bencze, Vaillancourt & Yoon, 2003; Van den Berg, Jansen & Blijleven, 2004), electronic discussion boards (Nicholson & Bond, 2003), handheld computers (Franklin, Sexton, Lu & Ma, 2007) and email (Cook-Sather, 2007). Many of these studies focus primarily on the use of technology to support teacher reflection and/or developing teachers’ familiarity and comfort with using technology as tool for learning. As with the large-scale PT3 projects, many also report that contextual factors likely had an impact on the outcomes of their research. However, these factors are typically treated as confounding variables or areas of concern, rather than as factors that helped to guide design.

Summary

A review of the literature suggests that availability of technology in schools is less of a concern than it was twenty or so years ago, and that recent studies now focus on how
technology is actually being used. Much has been written about the relationship between teachers and technology, and in particular, new efforts to improve teacher preparedness to integrate technology into their teaching. However, even some of the largest efforts around technology integration in teacher education (i.e., the PT3 projects) to date have indicated limited success and suggest that there are many contextual factors that are likely impacting outcomes.

While some authors suggest that little has changed with the integration of technology into education (Cuban, 2001; 1986), the researcher suggests that the current literature on technology integration in schools, and in particular in teacher education, may point towards the need for a new line of research that takes context into account as a design factor in supporting use of technology in teaching and learning, rather than treating it as a series of confounding variables after the fact. It may be possible that technology’s somewhat limited success in education to date has had something to do with the fact that the technology found in most schools has typically been designed for business contexts, not for learning contexts. Technology should not be treated as a one-size-fits-all tool (Vicente, 2003). Focusing more attention on the contextual variants of diverse educational contexts - if treated as design criteria (rather than as confounding variables) - may provide the needed scaffolding for technology and education to begin to come together in more effective ways.

Models of Technology Innovation and Integration in the Context of Education

This study is concerned with how a Human-Tech (Vicente, 2003) approach to technology innovation and integration could have an impact on technology-enhanced
learning practices in the context of teacher education. As such, the study was informed by current models of technology integration - also referred to as “technology infusion”. Each model will be described in detail, followed by a brief discussion of its implications for technology integration in the context of teacher education.

Although this literature mainly focuses on technology integration, and not technology innovation, it should be noted that researcher believes it is important to keep the two terms separate for the purposes of this study. This is to highlight the point that much of the literature that describes the integration of new and emerging technology in education typically treats the tools themselves as a static part of the socio-technical equation, and rarely as a conceptual artifact (Bereiter, 2002b) that is to be modified as part of the design process. While the researcher acknowledges that technological design is not necessarily always under the purview of educators - rather, usually the technical engineers - it is also the hope of the researcher that this separation between the educators and the technologists will begin to fade as newer models of technological design begin to increasingly take into account the unique attributes of learning environments that have implications for designing for learning.

**Knowledge Integration Model of Technology Integration**

This section describes a relatively new model of technology integration: the Technological Pedagogical Content Knowledge (TPCK) model - also called “TPACK” - proposed by Koehler and Mishra (2008; 2005).

The Technological Pedagogical Content Knowledge (TPCK) model was expanded from the original Pedagogical Content Knowledge (PCK) construct originally developed by Shulman (1986). Shulman proposed that teachers’ understanding of their
practice is highly dependent on two types of knowledge: knowledge of the content that they wish to teach (e.g., Math, Science, History), and knowledge of generally-accepted methods of teaching (e.g., classroom management techniques, lesson planning, assessment strategies). Shulman also suggested that to have either of these types of knowledge alone is not enough; good teaching requires the ability to think about both content and pedagogy as an inter-related, and un-fixed (or emergent) relationship.

Koehler and Mishra (2008; 2005) later expanded on the PCK model by including technological knowledge to the mix. In their model, teachers - who are already immersed in the context of a complex, socio-technical learning environment - need to consider all three types of knowledge (content, pedagogy and technology) when making decisions about how to best integrate technology into their teaching (see Figure 1). Koehler and Mishra state that, “Integrating technology into the classroom is a complex and ill-structured problem involving the convoluted interaction of multiple factors, with few hard and fast rules that apply across contexts and cases” (2008, p. 10). In addition to this, teachers must also consider how the three types of knowledge interact with each other, and how effective solutions to using technology emerge from this interaction, given the individual context in which teaching is taking place. According to Koehler and Polly (2008):

True technology integration is understanding and negotiating the relationships between these three components [content, pedagogy and technology]. A teacher capable of negotiating these relationships represents a form of expertise different from, and greater than, the knowledge of a disciplinary expert (say a mathematician or a historian), a technology expert (a computer scientist) and a pedagogical expert (and experienced educator). Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional, relationship between all three components. (p. 1)
Following the TPCK model, there are four types of knowledge that pertain specifically to technology integration: technology knowledge, technological content knowledge, technological pedagogical knowledge and technological pedagogical content knowledge. Each of these is described below.

Technological Pedagogical Content Knowledge

**Technological Knowledge**

For Koehler and Mishra (2008), knowledge of technology needs to go beyond simply understanding how to use certain hardware and software, since this more functional aspect of technology is highly dependent on specific tools, which are constantly evolving. In other words, by focusing technology knowledge on usability a teacher’s skills are at risk of becoming quickly outdated. Instead, the authors suggest that technology knowledge focus on developing a broader understanding of technology and how it can support learning, the ability to recognize when technology could “assist or
impede the achievement of a goal” (p. 15) and to understand the lifelong process involved in acquiring technology knowledge, as new tools become available.

**Technological Content Knowledge**

According to Koehler and Mishra (2008):

Teachers need to master more than the subject matter they teach, they must also have a deep understanding of the manner in which the subject matter (or kinds of representations that can be constructed) can be changed by the application of technology. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology - or vice versa. (p. 16)

In other words, the authors are pointing out that technology integration ought to be influenced by what it is that teachers are trying to teach, and that different subject-matter can change the kind of technology that may be necessary. They also suggest that the technology can also have an impact on the subject-matter by “afford[ing] and constrain[ing] the types of content ideas that can be taught” (p. 16).

**Technological Pedagogical Knowledge**

Koehler and Mishra (2008) suggest that the kinds of technology that teachers integrate into their teaching can have an impact on the ways that teaching and learning is carried out in the classroom. For example, a common complaint about using SMART Boards® in schools is that they limit the number of students that can work on the board at one time; only one person can write on the SMART Board® at a time. In contrast, a more traditional chalkboard allows the teacher to have multiple students drawing on the board at the same time. While this difference may seem relatively subtle, the effect could be that the teacher is less able to design lessons that would require simultaneous participation from multiple students at one time.
The authors also point out the need for teachers to learn to “re-purpose” some technologies to suit their own pedagogical objectives, since many technologies are not designed with classroom learning in mind. They go on to say that this re-purposing sometimes also involves helping teachers to resist a “functional fixedness” towards technology. In other words, teachers need to be able to recognize the versatility of certain kinds of technology, and how it can be used to suit educational purposes.

**Technological Pedagogical Content Knowledge**

Koehler and Mishra (2008) explain that “technological pedagogical content knowledge is an understanding that emerges from an *interaction* of content, pedagogy and technology knowledge” (p. 17) Using TPCK as a model for understanding technology integration, teachers’ decisions about which technologies to use, how to use them and when to use them emerge through consideration of how all three knowledge domains - content, pedagogy and technology - relate, according to the specific context in which the teacher is teaching. It is not enough to simply consider any one of the three knowledge domains in isolation from the others. Using TPCK as a framework, one can begin to see how the answers to common questions from teachers about technology integration become both easier and more complex:

**Question:** Will using this technology (technology) help my students understand what I am trying to teach (content)?

**Answer:** It depends on the way you use the technology to support student activity for the lesson (pedagogy), given your particular teaching context.

**Question:** What is the best way to use this technology in my teaching (technology)?
**Answer:** It depends on what it is you are teaching (content), and what you want the students to do (pedagogy), given your particular teaching context. It’s possible that a different technology may work better.

**Question:** Will using this technology (technology) allow me to design better lessons (pedagogy)?

**Answer:** It depends on what you are trying to teach (content), given your particular teaching context.

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**Barriers to Technology Integration According to Koehler and Mishra**

According to Koehler and Mishra (2008), the customization of technology integration into teaching is made difficult by three problems, or barriers, associated with newer, digital technologies - that, they are: 1) protean in nature, 2) functionally opaque and 3) unstable. The first - the protean nature of digital technology - highlights the fact that digital technologies can be used for many different purposes. Although this can be considered a major affordance of the technology, it also means that there is a lot to learn in terms of functionality with this kind of versatility. The second point - that digital technology is often opaque - addresses the fact that functionality of computers is often hidden, or removed from its form. In contrast, analogue technologies such as a pencil’s appearance and its inner workings are much simpler and more directly related to the function of the tool. The third point regarding the instability of digital technology emphasizes that digital technology is constantly evolving (there’s always something new to learn), and that these rapid innovation design cycles can often lead to tools that are initially less than fully robust, and unreliable. The authors also describe the importance of
addressing social-cultural barriers associated with digital technology, such as: lack of knowledge of digital technology, lack of experience and competence with using digital technology for learning, perceptions that technology is someone else’s concern (i.e., the technologists), and varying types of “digital divides” related to things like access (i.e., have versus have not) and generational differences (i.e., digital natives versus digital immigrants).

Understanding the Impact of TPCK for Technology in Teacher Education

The TPCK model suggests that there are no hard and fast rules to understanding how to best integrate technology into learning. Rather, teachers must be able to think flexibly about the three knowledge domains - content, pedagogy and technology - within the context of their own classrooms. According to the AACTE Committee on Innovation and Technology (2008) there are seven implications of the TPCK model for teacher education. They are that teacher education programs need to:

1. Move away from offering technology experiences and courses in isolation and toward providing these experiences within content courses.
2. Work with teacher education faculty members to define and implement TPCK within each of the content area methods courses.
3. Emphasize the concept of teacher as designer in both preservice and in-service teacher education experiences.
4. Hire new content area teacher education and arts and sciences faculty who have rich design experiences with educational technologies.
5. Help teacher educators and both preservice and in-service teachers understand the affordances and constraints of the complete range of educational technologies in each of the content areas.
6. Help teacher educators and both preservice and in-service teachers understand the nature of the wicked [complex] TPCK problem, along with context-dependence of their multiple solutions to the problem.
7. Foster research and development work on the development of TPCK and the effectiveness of teachers who have and demonstrate TPCK. (pp. 298-299)
What is evident in both the TPCK model and the AACTE Committee’s list of recommendations is that technology integration in the context of teacher education ought to be geared towards developing certain knowledge, and aptitudes for working with technology in the context of teaching. However, conceptualizing technology integration in this way places a substantial emphasis on individual competency with respect to technology. While developing personal understanding and skill related to teaching with technology is not in itself a negative goal to have, it is nonetheless a narrow one to adopt. According to Vicente (1999), technology design needs to be considered within the context of the entire work system (or learning environment), not just according to cognitive attributes such as individual competencies. Furthermore, placing primary importance on teacher’s knowledge with respect to effective technology integration also conversely suggests that a teacher’s knowledge alone is to blame when things go wrong with technology.

One of the often understated, or under-reported, aspects of the TPCK model is the impact of the context on technology integration. A recent paper by Kelly (2008) on equity of access to technology using the TPCK model elaborates on the role of context. According to Kelly, the contextual features of the learning environment are important to consider because it “interacts with other elements to determine learning outcomes” (p. 52), it “offers potential obstacles as well as potential opportunities or affordances” (p. 53), it can “affect the achievement of individual students directly and indirectly” (p. 54) and because the context is what ultimately contributes to the complexity of teaching and the need for technological solutions that can accommodate that complexity. With respect
to equity issues, Kelly suggests that there are a number of contextual features of the classroom that can impact access to technology. Some of these features include: the arrangement of furniture in the classroom, the quality and quantity of technology, demographic characteristics of the students (e.g., ethnic, cultural, socio-economic, linguistic background), cognitive and physical characteristics of students, teacher skills and dispositions, school philosophy, parents’ and administrators’ expectations.

Although Kelly (2008) brings attention to a much-needed area of study within the TPCK framework, little is mentioned of how teachers should actually go about measuring these important attributes of their particular teaching context, and furthermore, how they ought to go about making technological design decisions regarding technology integration based on the information they are able to discern. One of the contributions of the current study is to show how information about the learning context can be gathered and organized in such a way as to support decision-making around technological design in support of technology-enhanced learning. Furthermore, by using a Human-Tech framework, through the implementation of a modified Cognitive Work Analysis (Vicente, 1999), the researcher shows that technology innovation and integration can expand beyond a focus on cognitive attributes of the learning system alone (such as teacher knowledge).

**Developmental Models of Technology Integration**

This section describes two well-known developmental models of technology integration: the Concerns-Based Adoption Model (CBAM) model proposed by Hord,
Rutherford, Huling-Austin and Hall (1987) and the phases of adoption proposed by Hooper and Reiber (1995).

**Concerns-Based Adoption Model (CBAM)**

The Concerns-Based Adoption Model (CBAM) was proposed by Hord, Rutherford, Huling-Austin and Hall (1987) as a way to describe the kinds of concerns teachers typically have towards the adoption of new innovations. The CBAM model was not originally developed to be specific to technological innovations. The authors mainly describe non-technical innovations such as new curriculum materials and educational programs. However, since it was first introduced two decades ago, researchers interested in the adoption of technology in education have used it as a way to describe concerns of teachers with respect to integrating technology into their teaching (see Brzycki & Dudt, 2005).

There are seven levels of concerns that Hord et al. (1987) propose in their model (Level 0 to 6). These levels are also grouped by category: self concerns, task concerns and impact concerns. Each of these levels is described below:

**Self Concerns:**

**Level 0 (Awareness):** This first level describes teachers who are not interested in, or concerned with the innovation.

**Level 1 (Informational):** In this level, teachers are described as wanting to know more about a particular innovation.
**Level 2 (Personal):** Once teachers know something about the innovation, this level describes a new concern, which is about how the innovation will affect them personally.

**Task Concerns:**

**Level 3 (Management):** At this level, teachers have begun integrating the innovation and are now consumed with questions about how to manage this transition. They may be concerned with things like: time that it takes to prepare materials, or set up of equipment, organizing students to use the innovation, etc.

**Impact Concerns:**

**Level 4 (Consequences):** The first of the Impact Concerns describes teachers’ questions about how the use of the innovation is ultimately affecting their students’ learning.

**Level 5 (Collaboration):** At this level, teachers begin looking to other instructors to compare what they are doing with what others are doing.

**Level 6 (Refocusing):** The final level, describes the point at which teachers, having used the innovation, now begin thinking about ways of improving their use of the innovation (ways of doing things better).

According to Hord et al. (1987), “The real meaning of any change lies in its human, not its material, component” (p. 6). In other words, for Hord et al. the impetus for change lies in the degree to which an innovation can address the concerns of the individuals (i.e., the teachers) who are meant to use them. The authors also mention that few teachers ever reach Level 6 on the CBAM scale, suggesting that the concerns of
individuals will also ultimately impact their use of the innovation (i.e., using it and then sustaining its use by making modifications to suit the particular learning context). Further to this, the authors also offer a scale to measure Levels of Use of the innovation (Table 1).

Table 1

*Levels of Use of an Innovation (Hord et al., 1987)*

<table>
<thead>
<tr>
<th>Level of Use</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - Nonuse</td>
<td>Little or no knowledge of innovation; no involvement with innovation.</td>
</tr>
<tr>
<td>I - Orientation</td>
<td>Takes some action to learn more about the innovation.</td>
</tr>
<tr>
<td>II - Preparation</td>
<td>Makes a decision to use the innovation and sets aside time to learn more about it.</td>
</tr>
<tr>
<td>III - Mechanical</td>
<td>Begins to use the innovation; learning to use it.</td>
</tr>
<tr>
<td>IV(A) - Routine</td>
<td>Now good at using the innovation, but there is no consideration for improving its use.</td>
</tr>
<tr>
<td>IV (B) - Refinement</td>
<td>Now good at using the innovation, but varies its use to improve impact for students.</td>
</tr>
<tr>
<td>V - Integration</td>
<td>Collaborates with colleagues to improve the use of the innovation with students.</td>
</tr>
<tr>
<td>VI - Renewal</td>
<td>Re-evaluates the quality of the innovation; seeks out alternatives or modifications, sets new goals to improve the impact for students.</td>
</tr>
</tbody>
</table>

The CBAM model and its Levels of Use scale provides a very clear framework with which to understand variations in levels and structure of technology integration, through the lens of individual differences, such as the kinds of concerns teachers typically face when considering using a new innovation in their classroom. Another developmental
model, proposed by Hooper and Reiber (1995), offers another framework with which to understand technology integration.

**Hooper and Reiber’s Phases of Technology Adoption**

Unlike Hord et al.’s (1987) model of Levels of Use, Hooper and Reiber’s (1995) model of technology adoption describes variations in integration as “phases”. Hooper and Reiber developed their model as a way to describe and understand patterns of technology adoption of the past. They comment that, “It is difficult to account for the rapid abandonment of technologies and innovations in education over the past 50 years” (A Model of Technology Adoption, second paragraph) and so, they set out to explore whether there were common links or trends associated with these abandonment cycles that could offer a way of understanding the kinds of transitions in thinking that will ultimately lead to change.

Hooper and Reiber’s (1995) model has five phases. Each of these phases is described below:

**Familiarization**

In this phase, teachers become aware of new technology and start becoming more familiar with them through things like workshops and information sessions. The authors point out that many teachers do not go beyond this initial phase of getting to know the technology.

**Utilization**

In the Utilization phase, teachers go beyond getting to know about technology and begin using it in their teaching. At this point, teachers become more comfortable using the technology. However, the authors also suggest that in this phase the teacher’s
relationship with the technology is still precarious. They mention that teachers can often become overly comfortable using the technology for limited purposes, and will also quickly abandon use of the technology when things start to go wrong rather than trying to troubleshoot.

**Integration**

According to Hooper and Reiber (1995), the Integration phase represents a “break through” for teachers. Teachers in this phase, begin to turn over some of their tasks and responsibilities entirely to the technology. At this point, the technology becomes a more critical part of the teaching process.

**Reorientation**

The Reorientation phase is probably the most significant turning point for the teacher. This happens when the teacher begins to adjust their thinking about learning, as opposed to the technology. In other words, the teacher begins to reconsider how the students’ learning can be best supported, and the role that the classroom environment - including various technologies - can play in that. The authors point out that the teacher begins to see teaching as more than just the delivery of content, rather, through the environment, the teacher can help facilitate the knowledge construction process for students.

**Evolution**

The final phase, signals that a fundamental change has, or is taking place in teaching as a result of new understanding and new opportunities afforded by technology, with the goal of continuously improving the teacher’s efforts to support student learning. The evolution phase is not a static resting point for technology integration; instead, it
represents a state of constant flux as the teacher now recognizes the need to keep re-evaluating what they are doing in light of new knowledge, new innovations and the dynamic context of their classroom.

Comparing the CBAM model (Hord et al., 1987) to Hooper and Reiber’s (1995) phases of adoption, it is apparent that both are focused on developmental changes in understanding, comfort level, competencies and perceptions at the level of the individual (i.e., the teacher). Therefore, much like the TPCK model (Koehler & Mishra, 2008) technology integration, and its success and failure, relies primarily on the personal, psychological attributes of the teachers.

The Impact of Developmental Models for Technology in Teacher Education

Using the two developmental models - CBAM and phases of technology adoption - as a framework for thinking about how to support technology integration in teacher education, what these models seem to suggest is that teacher education ought to be geared towards helping students develop an awareness of, and comfort with using new technology. Also, since both models point towards efforts to integrate technology into teaching, one could also imagine using the TPCK model (Koehler & Mishra, 2008), mentioned in the previous section, to support student teachers’ thinking and understanding of how to best facilitate learning by considering the content and the pedagogy, given a particular teaching context.

As with the TPCK model (Koehler & Mishra, 2008), what is unclear from these developmental models is the extent that the context in which technology is being integrated is considered. For example, if a teacher never reaches the point at which they
begin collaborating with colleagues to discover new ways of using the technology to support teaching (the Integration phase of the CBAM model), is that because they are not concerned about it, or because the culture of the school in which they are teaching does not value those kinds of efforts (e.g., by allowing teachers release time from teaching to conduct team teaching sessions around technology)? Furthermore, if a teacher education program refines their courses to include technology across their instruction (e.g., use of an online discussion forum), and students elect not to use them, does this mean that the program instructors have failed to successfully reorient their teaching (fourth phase of Hooper and Reiber’s model), or could it be that other aspects of the program limit students’ opportunities to take full advantage of the learning tools?

In the current study, the researcher will examine how multiple attributes of the learning environment (or the context) - in particular, a two-year teacher education program - can have implications for technology innovation and integration. These include attributes such as: opportunities to gain experience with technology, comfort levels with technology, and instructor priorities with regard to technology - which are the primary concern of developmental models of technology integration. However, the study also explores other factors, not specific to the cognitive attributes of individuals such as: political and organizational constraints, the availability and distribution of resources, and working relationships among key stakeholders in the learning environment.

Knowledge- and Skill-Deficit Models of Technology Integration

This section will explore knowledge- and skill-deficit models of technology integration. Two models will be discussed: the National Educational Technology
Standards (NETS) (International Society for Technology in Education, 2008; 2007), as well as the Information Studies, Kindergarten to Grade 12 curriculum document (Ontario School Library Association, 1999) since the location for this study was Ontario, Canada.

*National Educational Technology Standards for Teachers (NETS-T)*

The International Society for Technology in Education (ISTE) has developed a set of standards for both students (2007) and teachers (2008) with respect to integrating technology into teaching. The intention of the ISTE is that these standards be used as a guideline for framing knowledge and skills training for both preservice and in-service teachers. The National Educational Technology Standards for Teachers (NETS-T) consists of five broad categories, each of which is detailed below:

1. **Facilitate and Inspire Student Learning and Creativity**
   Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

2. **Design and Develop Digital-Age Learning Experiences and Assessments**
   Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS•S.

3. **Model Digital-Age Work and Learning**
   Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.

4. **Promote and Model Digital Citizenship and Responsibility**
   Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

5. **Engage in Professional Growth and Leadership**
Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources. (ISTE, 2008)

Within each of the five standards, there are four targets that describe the specific expectations for teachers with regard to technology integration. As with many knowledge- and skill-deficit models of learning and assessment (such as standardized expectations), the focus is on identifying what teachers ‘ought to know’ and/or ‘ought to be able to do’, or demonstrate. However, despite the degree of specificity of the NETS-T standards, there are still many things that remain unclear. For example, according to Expectation #5 (Engage in Professional Growth and Leadership), teachers ought to be able to demonstrate “the effective use of digital tools and resources” (ISTE, 2008). However, the meaning of “effective use” is what remains illusive. As a framework for understanding how to structure technology integration in a teacher education program, one would be left to decipher the meaning of “effective use” and how it is achieved in a given context; there is little information within the standards and their corresponding expectations with which to guide decision-making in this regard.

The ISTE has published many guidebooks, such as “IT’s Elementary! Integrating Technology into the Primary Grades” (Hamilton, 2007) and “Integrated Technologies, Innovative Learning: Insights from the PT3 Program” (Bailey & Rhine, 2005), which attempt to help teachers and teacher educators understand how to achieve effective technology integration, using the NETS-T (teachers) and NETS-S (students) expectations as a framework. Furthermore, in these guidebooks, many make reference to context as an important consideration when integrating technology. However, much of the work of
determining how to organize this contextual information, and ultimately how to inform and prioritize decision-making with respect to technology integration are left unclear.

**Information Studies, Kindergarten to Grade 12 (Ontario)**

In 1999, the Ontario School Library Association in Ontario, Canada - where this study took place - published the “Information Studies, Kindergarten to Grade 12” document that could support information-related expectations within the Ontario curriculum documents. This document includes three different strands of information standards, the second of which (Strand 2) pertains specifically to information technologies. Like the NETS standards, the expectations fall under a set of broader categories. These categories (“metaskills”) are: concepts and reasoning, organizing, communicating, and applying. Each of these metaskills is then expanded, with specific expectations described according to grade level. For a summary of the grade level expectations, refer to the Information Studies document (1999, pp. 71-75). The overall expectations under each of these metaskills are described below.

**Concepts/Reasoning**

Use information technology to define needs, select information, analyse and evaluate information, and reflect on and evaluate research.

**Organizing**

Use information technology to classify, gather and sort information, and revise product.

**Communicating**

Use information technology to explore information, collaborate with others, test ideas and present findings.

**Applying**
Use information technology to relate prior knowledge, locate information, synthesize findings, formulate conclusions and transfer knowledge and skills.

The Impact of Knowledge- and Skill-Deficit Models for Technology in Teacher Education

Unlike the NETS-T standards (International Society for Technology in Education, 2008), the Information Studies expectations (Ontario School Library Association, 1999) do not pertain specifically to teacher competencies; they are focused on student competencies. However, both models have implications for teacher education and suggest that teacher training ought to be geared towards developing teachers’ knowledge and skills for working with technology, for a variety of purposes (e.g., locating information, sorting information, collaborating with others, etc.). As with the previous models examined - the knowledge integration model (TPACK) and the developmental models (CBAM, and Phases of Adoption) - an emphasis is placed on individual competencies with respect to technology integration. Furthermore, like the previous models, very little is mentioned about the role of teaching context, and how information about the learning environment might be used to inform decision-making with respect to technology innovation and integration.

Summary

This section outlined three types of models for understanding technology integration in education: a knowledge integration model (Technological Pedagogical Content Knowledge (TPCK)), developmental models (Concerns-Based Adoption Model (CBAM), Hooper and Reiber’s Phases of Technology Adoption) and knowledge- and
skill-deficit models (National Educational Technology Standards (NETS), Ontario School Library Association’s Information Studies, Kindergarten to Grade 12 curriculum document). Although the models covered in this section are not meant to be an exhaustive list, they are some of the more well-known and commonly referenced frameworks currently in use for understanding technology integration in education, and specifically in the area of teacher education. The TPCK framework (Koehler and Mishra, 2008) suggests that what is important to technology integration in teacher education is developing teachers’ knowledge with respect to three inter-related areas: content, pedagogy and technology. In the CBAM framework, and Hooper and Reiber’s (1995) Phases of Technology Adoption framework, emphasis is placed on developing teachers’ awareness of, and comfort with using newer technologies. The NETS (International Society for Technology in Education, 2008) and the Ontario Information Studies standards (Ontario School Library Association, 1999) seem to indicate that technology integration in teacher education be centered on developing teachers’ knowledge and skills for working with various kinds of technologies, for different purposes. Closer examination of each of these three models suggests that there is a primary focus on the cognitive attributes of individuals (i.e., teachers and students) with respect to understanding technology innovation and integration. While cognitive attributes are important with respect to making decisions about technology innovation and integration, Vicente (1999) would argue that this perspective alone is a narrow one to take, and that multiple attributes of the learning context, beyond individual competencies, can have important implications for design.
In the current study, the researcher will examine the implications of using a Human-Tech (Vicente, 2003) framework for understanding technology innovation and integration in the context of teacher education. Through the implementation of a modified approach to Cognitive Work Analysis (Vicente, 1999) to support the Human-Tech framework, information about multiple attributes ("constraints") of the learning context is gathered, and then organized to support a systematic approach to design. Using this framework, cognitive attributes are taken into account - as with the other models discussed in this section - however, unlike the other models, cognitive attributes are not necessarily awarded primacy as design criteria, over other attributes of the system (Vicente, 1999).

**Understanding Technology Innovation and Integration through Design Research**

The methodology for this study is supported by a design research framework (Bereiter 2002a; Brown, 1992; Collins, 1992; 1999; Edelson, 2002; Woodruff & Nirula, 2005). Therefore, this section explores the use of design research as a tool for understanding technology innovation and integration. The author argues that while design research is useful for examining technology integration within complex social settings, it doesn’t go far enough in supporting the researcher’s understanding of the nature of that context, and how information about the context ought to guide the design and innovation process. At the time of this study, there were no generally-accepted ways of carrying out design research in an educational context that would allow researchers to take all the complexities of the socio-technical learning environment into account in a systematic and rigorous way, and as such, many attributes of the learning context remain hidden from the
researcher. The section concludes by exploring a Human-Tech framework (Vicente, 2003) for technology innovation and integration, which is supported through the use of a design tool called Cognitive Work Analysis (CWA) (Vicente, 1999). Using a modified application of CWA, the researcher is able to gather information about the “constraints” of the learning system, and those constraints are then used to help the researcher (in collaboration with the instructor) approach the design research process in a more deliberate and informed way.

**Defining Design Research**

In the past two decades, design research has been written about extensively, in part, in reaction to the desire of some researchers to increase the relevance and connection between research and practice (Collins, 1999). Until the mid-1970’s, research on teaching and learning was predominately carried out by traditional experimental researchers, in laboratories (Brown, 1992). Findings from research conducted in laboratories were often far removed from the complexities of classroom life, and therefore bore little obvious relevance to the concerns of practitioners. Collins (1999) argues that “Learning in the real world occurs in complex social situations, and laboratory methods of studying learnings so fundamentally alter the conditions of learning that it is not clear what to conclude from any such study” (p. 289). According to Brown (1992), shifts within the realm of cognitive research towards increasingly active models of learning (e.g., metacognition) contributed to a gradual gathering of interest in contextualized settings (e.g., classrooms) rather than decontextualized settings (e.g., a laboratory), for carrying out research on learning. As such, these contextualized settings also required that researchers change the ways in which the research was being carried
out. For some, this meant the adoption of increasingly qualitative methods of study such as ethnography, interviewing, focus groups, etc. However, design research offered another unique alternative to these other methodologies.

According to Bereiter (2002a), design research is not defined by a particular methodology (e.g., qualitative versus quantitative). Rather, design research is characterized by its purpose, which is “sustained innovation”. For Bereiter, design research is characterized by four things:

1. Design research involves working with designers, as part of the design process.

2. Rather than adopting a completely objective stance towards the research by distancing oneself from the process that is being studied (as is typically done in traditional Psychological research), design researchers immerse themselves in the context, and deliberately try to make something happen. Brown (1992) referred to this characteristic of design research by defending that “the Hawthorne effect is exactly what I am aiming for in my classrooms” (p. 165). In other words, design researchers purposefully attempt to affect their outcome rather than trying to separate their influence on it.

3. Design research is geared towards solving an existing problem, which is specific to a particular community of practice.

4. Design research is guided by goals that emerge as part of the design process. Research goals may change throughout the course of a study, through its iterative cycles of design and research.
Collins (1999) provided a list of seven criteria with which to compare design research to a more traditional psychological experimental methodology. The following list of Collins’ criteria is adapted from Woodruff and Nirula (2005):

**Laboratory setting versus a messy situation**

Design research is typically carried out in complex social settings, such as classrooms, rather than in laboratory settings.

**Single dependent variable versus multiple dependent variables**

While laboratory research typically isolates one dependent variable as the focus of study, in design research there may be multiple variables of interest in the study.

**Controlling variables versus characterizing the situation**

In laboratory research, the investigator normally attempts to control for the number of variables influencing outcomes in the study, whereas in design research, the investigator abandons this control in favor of rich and elaborate descriptions of the complexity of the context.

**Fixed procedures versus flexible design revision**

In an experimental methodology, procedures for the study are normally indicated up front and strictly adhered to through the course of the investigation. In a design research study, the investigator may change the direction of the study while it is in progress in response to contextually-situated and emerging needs within the research setting.

**Social isolation versus social interaction**

In traditional laboratory research, the investigator typically takes on the role of an outside observer, whereas in design research the investigator participates fully in the
context of the study. Furthermore, participants in a design study typically have some influence on the directions of the investigation.

**Testing hypotheses versus developing a profile**

In a traditional experimental study, the investigator normally sets out to ‘prove’ or ‘disprove’ a particular hypothesis or set of hypotheses whereas, in design research the investigator intentionally tries to ‘make something happen’, within a particular context; the investigator does not attempt to generalize their conclusions.

**Experimenter design and analysis versus coparticipant design and analysis**

In a traditional experimental study, the problem or focus of the investigation is normally determined by the researcher, whereas in a design research study, the focus of the study normally addresses some problem that is specific to the context, and that is of particular importance to the participants; the researcher and the participants take on the role of co-designers of the study.

**Problems with Design Research**

There is a constant tension between designing an exciting classroom for happy campers and maintaining research standards of control and prediction (Brown, 1992, p. 173).

The above quote captures one of Ann Brown’s (1992) main arguments about conducting design research (or “design experiments”): that, for research conducted in ordinary learning contexts - such as classrooms - there is often a trade off between the kind of experimental control that is necessary to make generalizable conclusions, and the desire to generate research conclusions that are likely to have some direct implications for issues pertaining to practice. In traditional Psychological (or experimental) research,
studies are typically carried out in research labs, with a single individual, and the
investigation is structured to focus on a variable that has been carefully isolated to ensure
that data has not been contaminated, and the resulting conclusions have not been drawn
upon confounding, mediating factors. More recently, educational design research has
centered on studies that are situated within real classrooms, with groups of students, and
the investigation is structured around a problem related to practice. Therefore, the
investigation is deeply embedded within the context being studied, and as a result many
variables come into play.

According to Brown (1992), the shift in location of research from lab to
classroom, has also led to an increased interest in context. However, as Brown points out,
“it is a nontrivial task to capture the rich social and intellectual life of a classroom” (p.
163) and “components are rarely isolatable” which “presents a methodological headache
for traditional psychology, allergic as it is to multiply confounded experiments” (p. 166).
This inability to “unconfound” (Brown, 1992) one variable from another is not specific to
design research alone; it is generally an attribute of qualitative research more broadly.
However, for design researchers the consequences of the unknowns can greatly amplify
the risk of researchers overcompensating for this uncertainty with overly large and
unmanageable data sets, and/or to “project creep” as more and more variables are
included over time into the research design (Baek, Hjalmarsön, Bannan-Ritland, 2008;
Dede, 2004). Furthermore, the risk for design research involving technology is that,
technological solutions for learning could inherit these problems - trying to address too
much, and subsequently supporting very little.
There are many positives to engaging in design research, for both researchers and practitioners including: 1) increased relevance - for the practitioner, the contextual situatedness of the research makes it more likely to be directly useful to teaching, and therefore making it more likely that the researcher’s work will find value beyond academic prose; 2) the overlapping of two traditionally disparate communities of practice - the co-participant relationship between researcher and practitioner enables education stakeholders to converge their efforts towards professional meaning-making and knowledge advancement as opposed to dividing their efforts; 3) sustained progress - the iterative design cycle helps ensure that ideas about best practice continue to expand and improve over time, rather than succumbing to outdatedness. There are also negatives to design research, such as: 1) time costs - design research takes time; time for the researcher to sufficiently acquaint themselves with a context, time in which to engage in aspects of design and re-design, and time to evaluate the impacts of each iteration; 2) uncertainty - since design research takes place in socially complex contexts (authentic learning contexts), there are often unforeseen problems or activities that can emerge throughout the course of a study, which would be difficult for the researcher to predict a priori. Therefore, the design researcher must have a certain tolerance for the unknown. 3) lack of generalizability - design research projects often employ the use of a mix of methodologies, both qualitative and quantitative (Reichardt & Cook, 1975) - also called a “mixed-method” - in which quantitative data can be used to increase the validity, interpretability, depth or scope of qualitative findings (Greene, Caracelli & Graham, 1989), however, quantitative data is not typically used to justify general claims as it would in a traditional experimental design. The fact that design research is carried out in
complex social contexts often precludes the researcher from claiming that a particular construct was not confounded by other mediating factors - factors that are also often difficult to identify and isolate (Brown, 1992).

**Implications of Design Research for Technology Innovation and Integration**

While both traditional experimental studies and design research might be concerned with the impact of technology for learning, design research allows coparticipants to develop better ways of using technology over time in a particular context. For a traditional experimental researcher, a technology-based intervention is likely to be fairly cursory, controlled for contextual variability, and focused on the outcomes of individual students. While findings from these types of studies are usually well-defined and very specific, they are most ideally suited to making broad decisions through generalizable conclusions around things like ‘use versus non-use’. For example, the outcome of an experimental study might show that the use of computers to support instruction can lead to increased content understanding. However, what the experimental study can not say for certain is how computers ought to be used to support learning in a particular context.

In contrast, a design researcher is likely to examine the use of a particular technology over time, within the context of a complex social environment. While findings from design research studies are typically much more broad (in how much they take into account) and descriptive than experimental ones, they are most ideally suited to making decisions within a specific context, rather than across contexts. This is because the research design (and therefore, also its outcomes) is highly dependent on the context, making it difficult to extrapolate from one situation to the next. Furthermore, although
design studies are typically very descriptive, design researchers are often left with a certain degree of uncertainty about the exact conditions that lead to the success of a particular intervention since the research has taken place in a complex social environment in which many variables can contribute to the outcome, and are often difficult to distinguish. This inability to “unconfound” (Brown, 1992) the variables can lead to criticism around the validity and reliability of technological design studies, and also leave the researcher uncertain as to how to re-direct their design in light of these invisible factors. In other words, although design research is often richly descriptive, it is the interplay of interactions that emerge from the innovations that remain illusive, yet perhaps the most vitally important to the outcome of the design. This may explain why technology can often succeed in supporting learning in one context and fail to support another, despite their similarities, if one assumes that there may be unobvious differences between the contexts that are affecting the outcome.

In the current study, the researcher shows how the use of a Human-Tech framework (Vicente, 2003) for understanding technology integration, through the implementation of a modified approach to Cognitive Work Analysis (CWA) (Vicente, 1999) can support the gathering of information about the - often invisible - “constraints” of a learning context, and subsequently facilitate a more systematic approach to carrying out design research involving technology innovation and integration. In particular, the researcher examines the use of a modified approach to CWA in the context of a two-year teacher education program, in which analysis of contextual constraints factor directly into the design of socio-technical innovations.
A Human-Tech Framework for Understanding Technology Innovation and Integration

“Context matters. The key to a successful technology isn’t the technology itself, but rather its affinity with its users” (Vicente, 2003, p. 299).

According to Vicente (2003), the world is currently experiencing a period of technological chaos, or a mismatch between technological innovation and current human social structures. This mismatch has become increasingly apparent in education, where some would suggest that technology has failed to support any substantial change in the way that learning happens in school settings (Cuban, 2001; 1986). Vicente suggests that there are three reasons for this technological chaos: 1) technology is “frequently too complex for people to manage”, 2) “‘softer’ aspects of technological systems (work schedules, team coordination, and so on) can also make people’s lives more difficult”, and 3) problems between people and technology are continuing to get worse, not better (p. 33). For Vicente, the way out of the current state of chaos is to find a solution in which social and technological structures are better linked together, in order that a better quality of life may be achieved (i.e., one in which fewer problems occur).

Vicente argues that over the last three centuries, there has been an increasing polarization between the arts and sciences, as well as a tendency towards the categorization of disciplinary boundaries, which has further lead to a divide between the human - or social - sciences and the technical sciences; he refers to these specialists as the “Humanistic” and the “Mechanistic” view. Vicente suggests that the separation of these views has lead to problems with technology that is not designed to fit with what we know about human factors, since these two groups of specialists rarely approach design solutions in a way that is mindful of the other’s vantage point. From an educational
perspective, it could be argued that our current learning systems only perpetuate these boundaries by distinguishing between disciplinary areas of study - such as, between the “hard” sciences (e.g., chemistry, physics) and the social sciences (e.g., psychology, sociology). More recently there has been an increase of ‘inter-disciplinary’ studies, in which the emphasis is on a crossing-over between two or more areas of study. However, inter-disciplinary programs are still relatively rare, suggesting that further improvements could be made to allow more wide-spread availability of boundary-free study - such as a mix between the “hard” and “social” sciences - as opposed to isolated options to which only a minority of students may benefit.

Vicente (2003) describes the world as a “vast ocean” of relationships between people and technology (p. 47). He explains that good “Human-Tech” (p. 50) relationships emerge when there has been careful consideration given to designing technology that fits with what we understand about the human factors of the people who are supposed to be using the technology. “If the human factor is taken into account, a tight fit between person and design can be achieved and the technology is more likely to fulfill its intended purpose” (p. 54). In a Human-Tech approach to design, the human factors are important because they identify what ultimately governs the behaviour of individuals. Therefore, knowing something about these human factors will help designers create technology that can take into account information that is likely to constrain action.

The framework that Vicente proposes for understanding human factors is the Human-Tech ladder (Figure 2). At the bottom of the ladder are Physical human factors, which deal with things like “size, shape, location, weight, colour and material” (p. 61), including what we know about the average anatomy and physiology of most people. For
example, most people could not lift a one ton object so any design that required a person to do that, would likely not be a good one. The next rung up on the ladder pertains to Psychological human factors, which describe fundamental characteristics about the ways that people think and process information, including what we know about patterns of human thinking and processing of information (e.g., the average capacity of short-term memory). The next rung outlines Team factors, which describe how individuals, or groups of people, “communicate with each other and coordinate their respective actions to achieve individual and common goals” (p 56). The fourth rung pertains to Organizational factors, which describe how teams of people make decisions about, and communicate, things like collective goals, incentives and disincentives, policies, and procedures. Vicente also points out that Organizational factors can affect behaviour at the lower levels of the ladder (e.g., scheduling conflicts - at the Organizational level - that lead to working overly long hours can contribute to fatigue, job dissatisfaction and resentment - at the Psychological level). The final rung relates to Political factors, which describe things like laws, regulations, political climate, “public opinion, social values and cultural norms” (p. 58).
Vicente argues that “design should begin by identifying a human or societal need - a problem worth solving - and then fulfill that need by tailoring the technology to the specific, relevant human factors” (p. 45). As the problem to be solved becomes more complex, so do the myriad of factors that need to be taken into account (i.e., the higher up the ladder you have to go). Understanding how to support learning in a socio-technical educational context is an example of a complex problem; one that has been given a lot of attention in recent years, but could be argued, has yet to result in consistent benefits, or long-term sustainability and change in the ways learning happens (Cuban, 2001;1986).
Identifying Relevant Human Factors through Cognitive Work Analysis

For Vicente (2003), the first step in any good design is to identify a problem worth solving. In education, one such problem is to find better ways of supporting learning in educational contexts that have quickly become increasingly technological places. The exact form that this problem will take will depend on the specific educational context being examined, but for now, it is sufficient to describe the more general educational problem of supporting effective technology-enhanced learning. The next step in the Human-Tech process is to uncover the human factors that will be relevant to design.

Cognitive Work Analysis (CWA) (Vicente, 1999) supports the creation of technological solutions that are informed by the unique attributes of the human systems in which they are meant to be used. In education, these “systems” could include contexts such as individual classrooms, schools, universities and colleges, program departments, etc. Attributes – or “constraints” as they are called in CWA - include things such as: the functional purpose of the system (e.g., why the system exists, what it was designed to do), the organizational goals of the system (e.g., visions and objectives for the system as a whole), individual capabilities of “stakeholders” in the system (e.g., skill requirements, training) and their perceptions of their role in the system, and the day-to-day kinds of work that are typically carried out within the system (e.g., in order to accomplish organizational objectives).

CWA was developed as a technological design tool in the more traditional “hard” sciences fields of engineering, aviation, medicine, and ergonomics over the past few decades (Rasmussen, Pejtersen & Goodstein, 1994). More recently, it has been expanded
by Vicente (1999) and has begun to make some headway in the “social” sciences (Fidel & Pejtersen, 2004) and specifically, in the learning sciences (MacKinnon, 2008; 2006; MacKinnon & Woodruff, 2008a; 2008b; 2008c; Nirula & Woodruff, 2008). The current research falls within the domain of the learning sciences, in which the researcher examined the use of a modified CWA in the context of a two-year teacher education program.

CWA is typically carried out through data collection procedures such as observations, documentation analysis (review of key documents), informal conversations with stakeholders, and extended interviews with key stakeholders, prior to initiating design. All data is then merged and used to support development of the human constraint analysis. The most extensive methodological account of CWA was described by Naikar, Hopcroft and Moylan (2005) in which the authors focus on analysis of the work domain component of the CWA model. Once data collection is complete, an analysis of the relevant human factors is carried out (“constraint analysis”) and is then subsequently used to support socio-technical design for the particular system of interest (i.e., the one in which the CWA was carried out).

Vicente’s (1999) writing on CWA, which elaborates on the difference between CWA (which he referred to as a “formative work analysis”) and other types of work analysis, suggests the following important caveats regarding technological design:

1. **That behaviour in a work system is situated in a context:** Work is always carried out in some particular work context, and therefore design should bear that context in mind. Good design will recognize the limitations of assuming a ‘one size fits all’ approach.
2. **The context-conditioned variability of work**: Not only is work understood to be bound to a particular context, it is also acknowledged that conditions of that context can change. In particular, in open, complex social systems, in which conditions can vary - such as a learning context - needs, problems and goals of the work system can change and evolve in ways that can not always be predicted.

3. **There are intrinsic aspects of work**: There are often elements of a work context that are not directly observable in its current practices, but nevertheless have an impact on behaviour. These intrinsic constraints delimit the currently unexplored possibilities for work-related design. In complex social systems, Vicente argues that intrinsic aspects of work should be given primacy of concern for designers, rather than cognitive - or psychological - factors (although he acknowledges that these are also important to design).

4. **That behaviour evident in current practice is not always directly related to goals of the work system**: There are often aspects of current work practices that have little direct relationship to carrying out the goals of the work system, yet they may serve some adaptive purpose. These “workarounds” often help to identify potential areas of improvement for the work system.

For Vicente (1999), it is the last two points that distinguish CWA from other types of work analyses such as Task Analysis (which he calls a “normative approach”) or
Activity Theory (which is called “descriptive approach”). Vicente (1999) also points out that CWA shares some of the qualities of the aforementioned work analyses (such as the context-conditioned variability assumed with descriptive work analyses), however, CWA’s distinction lies in its ability to also “design for adaptability” by revealing the inherent aspects of a work (or learning) system (“intrinsic constraints”) that are not necessarily apparent in its current practices, but nevertheless have an impact on the ‘boundaries on action’ for individuals in the system.

**Summary: Linking Cognitive Work Analysis to Design Research**

One of the unique attributes of design research is that, over time, investigators develop a personal acquaintance with their research context, by taking on a role as co-participant as opposed to a third-party observer. This personal acquaintance allows the design researcher to make decisions that are more closely tied to the goals of the context since they are made through an ongoing consultation with participants. However, in becoming immersed in the context, a relationship begins to emerge between the researcher and the context that can be difficult to separate. This “insider” status could cause a transformation of research procedures from being a deliberate, objective decision-making process into a more fluid series of intuitive actions. The consequence of this intuitive action is that variables may be even more difficult to “unconfound” (Brown, 1992).

There is a potential for CWA to provide a bit of a life line to researchers that will allow them to do the necessary ‘diving into’ their context while at the same time allowing them to come ‘up to the surface’ again from time to time to re-evaluate the outcomes of
their design. Since the constraint analysis is performed at the beginning of the study, at a time in which the researcher has less of a personal acquaintance with the context, it allows the researcher the time and opportunity to develop their familiarity with the human factors relating to action that will eventually become important to design. However, the constraint analysis also serves as a marker, or a reminder, of those initial factors once the researcher has become well immersed in the context. Lastly, by focusing on the intrinsic aspects of the learning context, in addition to its directly observable practices, CWA provides the opportunity for the researcher to find entirely new ways of supporting technology innovation and integration that have not yet been considered.

The current study examines the use of a Human-Tech framework to support technology integration in the context of a two-year teacher education program, in which a problem was identified with respect to supporting teacher candidates in carrying out classroom-based research as part of their initial teacher training. The goal of this research is twofold: 1) to explore the potential of using a Human-Tech framework for understanding technology integration in the context of teacher education and, 2) to examine the impact of a socio-technical tool (the open online research support forum) that was designed using a Human-Tech framework. As part of the first goal of the study, the researcher explores the potential of using a Human-Tech framework through the implementation of a modified version of a technology design tool called Cognitive Work Analysis (CWA) (Vicente, 1999). The results of the modified CWA were used to directly support technological design and decision-making throughout the course of the study.
Summary

This chapter began by examining the role and status that technology plays in education, with particular reference to technology-enhanced learning in teacher education. A review of the literature suggests that technology integration in education, and in particular teacher education, has had limited success and many studies point to contextual factors as barriers to outcomes such as implementation and sustainability.

The researcher then explored existing models for understanding technology integration in education - a knowledge integration model, developmental models and knowledge- and skills-deficit models - and their implications as frameworks for understanding technology-enhanced learning in teacher education. An examination of these current models suggests that there is a primary focus on the cognitive attributes of education stakeholders (i.e., teachers and students) with respect to understanding technology innovation and integration. Furthermore, although some research indicates the importance of broader contextual factors as design criteria for technology, current models for understanding technology integration in education fail to indicate how these factors ought to inform design.

Third, the researcher describes the current role of design research in discovering ways to effectively integrate technology into learning, as well as its limitations as a tool for collecting and organizing information about context in such a way that it can inform design. This section concludes with a look at a Human-Tech model for understanding technology innovation and integration, and the implementation of a tool called Cognitive Work Analysis (Vicente, 1999) as a way to uncover and organize relevant contextual
information that may have implications for design - information that, up until now, seems to have been somewhat left out of the design process in education.

Throughout the chapter the researcher develops an argument to support the idea that a combination of theoretical perspectives that have been confined to cognitive attributes of education stakeholders in supporting frameworks for understanding technology integration, in addition to limited methodological means (of design research) for examining attributes of the learning context that may be important to design, has lead to recent efforts to support learning through the use of technology to be extremely narrow in focus. This study will show how Vicente’s model of a Human-Tech (Vicente, 2003) approach to design can support a new - broader - way of thinking about technology innovation and integration in education that is not limited to cognitive attributes of stakeholders (i.e., students and teachers), and acknowledges the important relationship that exists between context and technology for design. Furthermore, the application of Cognitive Work Analysis to design research as a tool to uncover and organize relevant contextual information, can potentially offer a new methodological approach to support the “unconfounding” (Brown, 1992) of variables - or human factors - that may have implications for design, in a teacher education setting.

The over-reliance on models of technology integration in education that focus on cognitive attributes of stakeholders (i.e., students and teachers) is perhaps symptomatic of a more general emphasis in society on ‘changing the people to fit the tools’. Vicente (2003) says “The prevailing role of technology in society treats people as stupid and sees ‘design for dummies’ as the solution to our frustrations and difficulties. It doesn’t treat people with the dignity that they deserve” (p. 299-300). The problem of how to
effectively integrate technology into complex learning environments requires a complex approach. Designers need to look beyond simply the psychological attributes of individuals for their design criteria and rationales for the failure of technology to thrive in education. A Human-Tech framework for understanding technology innovation and integration suggests that there are a multitude of human factors that may be relevant to design, including Physical, Psychological, Team, Organizational and Political constraints.

In the next chapter, the researcher will describe how a modified approach to Cognitive Work Analysis was integrated into a design research study, to identify the human factors relevant to technological design in the context of a two-year teacher education program.
CHAPTER THREE: METHOD

This study uses a design research approach (Bereiter 2002a; Brown, 1992; Collins, 1992; 1999; Edelson, 2002; Woodruff & Nirula, 2005) to explore the potential of a Human-Tech framework for understanding and informing the design of technology-enhanced learning practices in the context of teacher education. This Human-Tech framework was explored further through the implementation of a modified technology design tool called Cognitive Work Analysis (CWA) (Vicente, 1999), which allows the researcher to collect information relevant to the particular context in which the technology will be used, and that could point to key design implications. In this study, results from a modified application of CWA was applied to the design of an open online research support forum, to support teacher candidates in carrying out their action research projects as part of their initial teacher preparation. In this chapter, the researcher describes the timeline of the study, the context of the study, the participants, the data collection methods employed across a three-year period, and the methods of data analysis used. The strengths and weaknesses of applying the use of Cognitive Work Analysis in the context of a graduate level teacher education program, is also described throughout.

Timeline of the Study

As mentioned in Chapter 1, the current study followed more of a winding path than a straight and narrow one. The following section attempts to clarify the steps taken by the researcher over the course of the three years of the study.

According to Vicente (2003), technological design should begin by identifying a problem worth solving, and then fulfilling that need by tailoring the technology to address the relevant human factors within the problem context - i.e., the system, or in this
case the learning environment. For the purpose of clarification, the research is divided into three phases: Phase 1) problem identification, Phase 2) Cognitive Work Analysis, and Phase 3) the design study (Table 2). However, it should be noted that while the word “phase” is typically meant to convey a temporal distinction, in this case the word is used to describe a distinction in research focus. Therefore, some of the phases overlap temporally.

Table 2

*Timeline of the Research*

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Phase 1</strong> (Problem Identification)</td>
<td>• Pilot study in the MA-CD program</td>
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<td></td>
<td>• Informal observation and discussion in the MA-T program</td>
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<td></td>
<td>• Identified problem focus for design study</td>
<td></td>
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<tr>
<td><strong>Phase 2</strong> (Cognitive Work Analysis)</td>
<td>• Began CWA documentation analysis and stakeholder interviews in MA-T program</td>
<td>• CWA interviews with stakeholders continued; surveys also administered to triangulate information.</td>
</tr>
<tr>
<td><strong>Phase 3</strong> (Design Study)</td>
<td>• Innovation 1 of the design study was implemented</td>
<td>• Innovation 2 of the design study was implemented</td>
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Beginning in the 2005-2006 academic year, the researcher completed a pilot study to examine technology-enhanced learning practices in the context of a two-year graduate level teacher education program, specializing in child development (MA-CD). During the
same year, the researcher was involved with other teaching experiences - including in another two-year graduate teacher education program, focused in Curriculum and Teaching (MA-T), at the same university. The combination of the experiences in both two-year programs (pilot study and teaching) led the researcher to develop the main study reported here. In both the pilot study, and the teaching experiences, the two-year programs had adopted an infusion approach to technology integration (i.e., technology is included within all courses as opposed to being a stand alone course). However, the researcher also noted that technology integration varied from course to course, from none at all to full integration (Rowley, Dysard & Arnold, 2005), and in both cases technology played a predominately administrative role in teaching and learning (i.e., email communication, and a discussion board to handle program announcements, and to circulate documents and forms).

Towards the middle of the 2005-2006 academic year, the researcher read Vicente’s (2003) book entitled “The Human Factor: Revolutionizing the Way We Live with Technology”, and also became familiar with the implementation of a technology design tool called Cognitive Work Analysis (see Chapter Two) while working on another research project. At this point - after numerous limited successes with implementing technology-enhanced learning in a variety of teacher education settings (including the pilot study) - the researcher began to reformulate the purpose of her study towards a focus on understanding how technology could be designed to support more effective human-technology relationships in the context of teacher education. Looking ahead to the next academic year, the researcher decided to focus on the MA-T context for the study.
The MA-T program was an ideal context to begin looking at the potential of a Human-Tech framework to inform technological design in education, since it is a small program with less than 100 students and only 9 faculty members; while still a complex social context, this made it a relatively ‘closed system’ (Vicente, 1999) in which to investigate. In this program, the researcher had noted - through informal observation and discussion with program stakeholders (i.e., students and faculty) - that there was a problem associated with supporting the students’ research projects (a major component of the program). Students had voiced concerns that they were not given enough support to carry out their research projects, and that they felt confused about the process and isolated from the work others (their peers) were doing. One of the faculty members in the program - who ultimately became the primary instructor-participant in the design study - had also noticed that the students were upset about the research process, and that the quality of their work varied considerably, from below what she would expect from a graduate level student, to exceptional. She also noticed that the students had very few opportunities to share their research with one another. Furthermore, the researcher noted that the research projects were supervised by a faculty member however, many students only met with their supervisor a few times over the course of the year, either face to face or through email.

In June of 2006, the researcher began the formal process of investigating the use of a Human-Tech framework for technology integration through implementation of a modified Cognitive Work Analysis (CWA), including CWA interviews (Phase 2) with key stakeholders in the program (i.e., students, faculty, senior administration). The
interviews extended into the beginning of the second year of the study, since many stakeholders were not available during the summer session.

In September of 2006, the design study began (Phase 3). Although the CWA procedure was not fully completed, the researcher decided to initiate the first iteration of the design study based on the information that had been gathered to date. It should be noted that under normal circumstances the CWA is completed prior to design. Vicente (1999) points out that it is important for the designer to not make any assumptions about the design beforehand. With an incomplete CWA, it was necessary for the researcher to make some assumptions about what the design should look like based on what was known at the time. However, the researcher decided that it was important to begin the design phase for the following reasons:

1. Since the design study was being carried out in a graduate level program, the researcher needed to abide by university policy that course expectations must be made clear to students at the beginning of the course. Since the design would be linked to the students’ Psychology course in their program, this was an important factor to consider as it would limit the extent of the design decisions that could be made after September.

2. Deferring the design study until the CWA could be fully completed would mean that Innovation 1 would not begin until the following academic year. This would mean that the students in the 2006-2007 academic year would not be able to potentially benefit from any supports that emerged from the research to that point.

3. By running the design study and the remaining CWA interviews concurrently, the researcher would be able to target some of the stakeholder questions towards information that could have direct implications for the design that was implemented.
By the middle of the 2006-2007 academic year, the researcher was able to complete a draft of the human factors constraint analysis (identification of the human factors relevant to design). The additional information that came out of the remaining CWA interviews - as well as surveys that were administered - confirmed that the design was targeting some of the key constraints that the researcher had identified prior to September. The benefit of the additional information was that the number and relative importance of particular constraints became much more apparent. Having confirmed the constraints that were relevant to design in Innovation 1, and given the limited resources available to the researcher, the full transcription, analysis and verification procedures began at the end of the 2006-2007 academic year (which marked the end of Innovation 1).

In the summer of 2007, the researcher began the full transcription of all the stakeholder interviews (approximately 14 hours of audio recordings), analysis of the constraints, and verification procedures. In order to expedite this process as much as possible, half of the interviews were sent to an external transcriber and half were completed by the researcher.

In the 2007-2008 academic year, Innovation 2 of the design study began. The same constraints that were targeted in Innovation 1 were targeted in Innovation 2, with the addition of two new constraints that emerged during the 2006-2007 academic year (i.e., constraints that had not been identified through the original CWA procedure).

It is important to note that there are many differences between educational contexts and other kinds of work contexts (such as the medical industry, airline industry,
in which CWA has been carried out) that may preclude educational researchers from strictly adhering to CWA protocols used in preceding studies and reports. The researcher’s decision to make adjustments to the way in which CWA was used to inform design was done in order to suit the particular context of a graduate level teacher education program. Specifically, in this context adjustments needed to be made for time reasons, limited access to resources, limited access to key stakeholders, and university policies around course expectations. Therefore, throughout this report CWA is referred to as a ‘modified CWA’ where necessary, to distinguish it from the general approach taken by others such as Vicente (1999).

**Design Research**

This study follows a design research approach to investigating the use of technology in the context of a teacher education program. Design research is ideally suited to studies that are embedded in complex social contexts since they take place in authentic learning environments as opposed to a laboratory setting. As discussed in the previous chapter, rather than trying to isolate a single variable the researcher abandons the controlled experimental design and embraces the natural complexity of the setting. As such, the researcher takes on the role of a co-participant in the design process, as opposed to being an objective third party observer. This close relationship between the theoretical and the practical helps ensure that research findings are more meaningful to the practitioners.

However, the very thing that makes design research ideal for investigating authentic settings - its connection to practice - is the same thing that makes it vulnerable
to things like overly large and unmanageable data sets, and/or to “project creep” as more and more variables are included over time into the research design (Baek, Hjalmarson, Bannan-Ritland, 2008; Dede, 2004). The “confoundedness” (Brown, 1992) of the design can make it difficult for the researcher to know for sure which variables are having an impact on the outcomes. Furthermore, as the researcher takes on an increasingly “insider” role in the setting - through co-participant design - decision-making may become more intuitive and less systematic, further compounding this confoundedness.

In the current study, the second phase of the research involves exploring the use of a tool called Cognitive Work Analysis to help the researcher identify and organize contextual information in such a way that it can support a more systematic approach to the design study. Most models of design research depict a cyclical, iterative pattern of investigation beginning with a problem that needs to be identified. Figure 3 below provides a prototypical example of the design research cycle.

![Figure 3. A Prototypical Design Research Cycle](image-url)
Like design research, a Human-Tech approach to design through the application of CWA is geared towards solving problems. Where the researcher proposes that CWA best fits into the design research process is prior to the initial exploration of design options. Once a design has been implemented, results from the CWA (the human factors constraint analysis) can also be used to support evaluation and the reflection stage of the research cycle, helping to interpret both the outcomes, as well as plan for future design. As much as possible, given the limitations imposed on the researcher by the context of the study, the CWA was carried out prior to design. However, as mentioned, some aspects of the CWA had to be carried out after the implementation stage had begun.

Currently in education, there are no known procedures for identifying, organizing and prioritizing information prior to engaging in the design research cycle. Outside of education, other types of work analysis (in fields like engineering, computer design and ergonomics) have been used to inform design such as, Task Analysis and Activity theory. However, Vicente (1999) argues that Task Analysis does not take into account contextual variability - that similar contexts can differ, and changes within a given work context can be unpredictable. He also argues that Activity Theory, while it takes into account contextual variability, emphasizes design decisions that are based on observations of current practice which can often lead to technologies that merely perpetuate existing problems - which Vicente (1999) calls the “task-artifact cycle” (p. 104). In contrast, CWA and design research emphasize the importance of sustained innovation (Bereiter, 2002a), which Vicente (1999) argues can only happen if designers look beyond the information available through examining current practices alone. Vicente points out that while CWA shares some of the qualities of the other types of work analyses, it’s
distinction lies in its ability to also “design for adaptability” by revealing the inherent aspects of a work (or learning) system (“intrinsic constraints”) that are not necessarily apparent in its current practices, but nevertheless have an impact on the ‘boundaries on action’ for individuals in the system.

Research Context

This study takes place in the Faculty of Education at a large urban university in Canada. The Faculty of Education offers multiple teacher education programs including: an eight month consecutive (post-undergraduate) program in which students graduate with a Bachelor of Education, a five-year concurrent program in which students graduate with an undergraduate degree in a particular area of study in addition to a Bachelor of Education, a two-year consecutive program in which students graduate with a Masters degree in the area of Child Development (MA-CD), and a two-year consecutive program in which students graduate with a Masters degree in the area of Curriculum and Teaching (MA-T). The primary focus of this study was on the two-year consecutive MA-T program.

The MA-T program is a Primary-Junior (PJ), and Junior-Intermediate (JI) teacher preparation program, and is relatively small in comparison to other Bachelor of Education programs (eight month consecutive and five year concurrent). In the first year of this study there were 65 MA-T students (41 first year students, and 24 second year students), and in the second year of the study there were 82 students (41 first year students and 41 second year students). In contrast, the consecutive Bachelor of Education program has an enrollment of over 1200 students per year, and the concurrent Bachelor
of Education program has approximately 135* students. In the MA-T program, students each year represent a new class cohort, taking the majority of their classes together over the two-year period of the program.

There are also a small number of faculty members in the MA-T program. During the first year of the study, in which the Cognitive Work Analysis stakeholder interviews began, there were 9 faculty members (including full time faculty and contract instructors), which is much fewer than in the Bachelor of Education programs which typically have many faculty and even higher numbers of contract instructors. In the second year of the design study (Year 3 of the research) there were a total of 12 faculty members in the MA-T program - still much fewer than in most other teacher education programs.

Students enrolled in the MA-T program are required to complete two consecutive years of study at the graduate level, in the area of Curriculum and Teaching. As part of their program, students take a number of traditional methods courses (e.g., Math, Science), foundations courses (e.g., Psychology), in addition to graduate courses in the area of adaptive instruction, and anti-discrimination. Students also complete four teaching placements (two per year). In the second year of the program, students are required to carry out a research project on a topic of their choice related to teaching. As part of the research project, students must form a research question, collect data, analyze their data and produce a written report, under the supervision of a faculty member (usually a MA-T faculty member).

* *This reflects 2007-2008 data only since this is when the concurrent program began for this university.
One of the primary goals of this study is to explore the use of Human-Tech framework - through the implementation of a modified Cognitive Work Analysis - to inform the design and integration of technology that could be used to support work carried out as part of the MA-T program. At the beginning of this study, there was some technology already in use in the program, such as email and discussion boards. In general, the MA-T program had adopted an infusion model to technology integration (technology is integrated into all courses, as opposed to a stand-alone course) however, the use of technology varied from instructor to instructor from no use, to full integration (Rowley, Dysard & Arnold, 2005).

The majority of this study is carried out in the context of the Psychology foundation course, in which technology had already been fully integrated. The Psychology course was chosen as the primary location for the majority of the study since this instructor was already receptive to the idea of technology integration, and was willing to modify her pedagogy and explore new ways of using technology. The instructor for the Psychology course is highly experienced with integrating technology into her teaching, and has an extensive research background in the area of online learning. Prior to the study, the instructor had been using an open online discussion forum to encourage critical reflection of course content in addition to extending students’ thinking beyond course boundaries to include other aspects of work carried out as part of the program (e.g., encouraging students to make connections between learning theory and the research they were carrying out on aspects related to teaching). Despite much effort on the part of the instructor to effectively integrate technology into her course, observation by the researcher of students’ use of the open online discussion forum
suggested that the students varied in the degree to which they participated and saw value in using the technology to support their learning. Many of the students disliked using the online forum mentioning that discussion took a lot of time away from other required work in the program.

What the researcher’s experience in both the two-year MA-CD (pilot study) and MA-T programs (Phase 1) seemed to suggest was that efforts to integrate technology (beyond administrative tools such as email and a program discussion board) to support aspects of student learning and work carried out as part of the program were failing to meet both the needs of primary stakeholders (i.e., both students and faculty) and in some instances, the goals of the program. Therefore, the purpose of the research is to explore how a more effective Human-Tech (Vicente, 2003) relationship could be developed to support work in the MA-T program, through the implementation of a tool called Cognitive Work Analysis (CWA) (Vicente, 1999), which would allow the researcher to identify and organize the human factors relevant to design. In other words, the researcher attempts to design the technology used in the program to better fit the relevant human factors identified through the CWA.

The Open Online Discussion Forum

The “hard” technology (hardware/software) that became the object of design in the study was an open online discussion forum called Knowledge Forum®. Knowledge Forum® (KF), originally called “CSILE” (Scardamalia, Bereiter, McLean, Swallow & Woodruff, 1989), was designed in a university-based research context, for the purpose of supporting various inquiry communities with carrying out knowledge building work (Scardamalia, 2002).
The outcomes of the modified CWA lead the researcher to decide that an open online discussion forum could be used to support work carried out in the MA-T program (specifically around the students’ research projects). Although there were a number of online discussion forum tools available at the time of the study, the researcher chose to use Knowledge Forum® for three reasons: 1) because this particular tool has a flexible design, with many functions, that would allow the researcher to tailor the environment to accommodate different constraint priorities, 2) because Knowledge Forum® is equipped with a data analysis function, called the Analytic Toolkit, which would allow the researcher to run various queries on the database that supports the online environment (e.g., to find out how many notes each person has read) - this data could then be used to triangulate other data sources (Creswell, 2007) and 3) because the researcher has regular contact with the Knowledge Forum® design team and would have an opportunity to suggest design changes related to the technology based on the outcomes of the constraint analysis, and innovations applied throughout the study.

The Psychology Course

The Psychology course that was the main physical location for much of the study is a required foundation course in the MA-T program. In this course, students are introduced to key principles of learning and development, and explore their application to practice. Students take this course during their second year in the MA-T program, and it runs for the entire academic year (September to April). The class meets face-to-face roughly once a week, with the exception of practicum when students are doing their teaching placements in schools. Practicum usually occurs over a four or five-week time
period, and happens twice during the academic year (once in the Fall session and once in the Winter session).

One of the major assignments for the Psychology course involves students engaging in Knowledge Forum® to discuss the content of the course, and to make connections across their program experiences (e.g., other courses, practicum). Students are expected to contribute one or two notes per week, prior to the face-to-face class. If students are moderating (leading) the online discussion for that week, they would be responsible for checking the discussion more regularly and contributing more often to keep the discussion going. Although the weekly discussions as part of the Psychology course are not the main focus of the study, it is important to note that students regularly interacted with Knowledge Forum® as part of this course.

**Participants**

The student participants for this study were taken from a two-year consecutive (post-undergraduate) teacher education program in which students graduate with a Masters degree in the area of Curriculum and Teaching (MA-T). Students enrolled in the MA-T program have already successfully completed a four-year undergraduate degree, at the honors level, and they are typically in their mid to late twenties although a small number of students may be older than this, coming to teacher education as a second career. The faculty participants in this study were taken from the same program, and they represent a mix of full time faculty and contract instructors. The study focused on the students enrolled in the second year of their program for two reasons: 1) because they would be able to provide insight into the program as part of the CWA stakeholder
interviews since they have already completed one year of the program, and 2) because this is the year in which the students carry out their major research project, which was the central problem focus identified in Phase 1 of the study.

In the 2006-2007 academic year, there were a total of 24 second year MA-T students and 9 faculty members (Table 3). All except one of the students agreed to participate in the study (n=23), along with 7 of the 9 faculty. Approximately one third of the students agreed to participate in the extended CWA interview (n=8) and all 7 participating faculty members agreed to be interviewed. However, one of the faculty members was eliminated from the list of interviews due to leaving the MA-T program temporarily for personal reasons. In the 2007-2008 academic year, there were a total of 41 second year students and 12 faculty members (Table 3). All except three students agreed to participate in the study (n=38). Although the interview portion of Phase 2 (CWA) had been completed, student participants were asked to complete a survey which included a series of questions to verify the student data from the previous year. Just over half of the 38 student participants responded to the questionnaire (n=20). Furthermore, since the interview portion of Phase 2 had already been completed, there was only one faculty participant (i.e., the primary instructor-partner in the design study) required in Phase 3.

Table 3

<table>
<thead>
<tr>
<th>Participation in Phase 2 and 3 of the Research</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>2006-2007 Academic Year</strong></td>
</tr>
<tr>
<td><strong>2007-2008 Academic Year</strong></td>
</tr>
<tr>
<td><strong>No.</strong></td>
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<tr>
<td>Total students</td>
</tr>
<tr>
<td>Total faculty</td>
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<tr>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
</tr>
<tr>
<td>No. of students who agreed to participate in the design study</td>
</tr>
<tr>
<td>No. of students who participated in the CWA interviews</td>
</tr>
<tr>
<td>No. of faculty who agreed to participate in the design study</td>
</tr>
</tbody>
</table>

*Only one faculty member was required for Phase 3 of the study.

**Ethical Considerations**

Students and faculty in the MA-T program were approached at the beginning of each academic year to request their participation in the design study. At the beginning of Phase 2 of the research, two faculty members were approached about participating in the CWA interview during the summer session in 2006 (prior to the beginning of the 2006-2007 academic year) since they were available to be contacted at that time. The remaining participants were contacted in either September 2006 or September 2007, as per their involvement in the study. The researcher outlined the nature of the research and provided a letter of consent that was to be reviewed and signed by each individual (see Appendix A through D for consent letters for each participant type, for each year). Those agreeing to participate were also provided a copy of the consent form for their records. The researcher explained that participation in the study was strictly voluntary, and that individuals could withdraw their consent at any time. Although all students were permitted to use the open online research support forum designed as part of this study, only the data from those individuals agreeing to participate was analyzed.
Data Collection and Analysis

Over the course of the research, a variety of data was collected in the form of observations, field notes, informal discussion, questionnaires, interviews, documentation analysis (analysis of key documents in the MA-T program), and analysis of student participation in an open online research support forum using both qualitative (content analysis) and quantitative (Knowledge Forum® Analytic Toolkit) approaches. The following table (Table 4) summarizes the data collected over the years, according to each phase of the research.

Table 4
Description of Data Sources Gathered during the Research

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Phase 1 (Problem Identification)</td>
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<tr>
<td>Pilot Study in the MA-CD program</td>
<td>Observation • Field notes • Questionnaire • Interviews • Quantitative analysis of online notes (ATK)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation in the MA-T program</td>
<td>Informal observations • Informal discussion with stakeholders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 2 (Cognitive Work Analysis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CWA</td>
<td>Documentation analysis • Stakeholder interviews (2) • Informal discussion with instructor-participant</td>
<td>Documentation analysis • Stakeholder interviews (12) • Questionnaires (faculty, students) • Observations • Field notes</td>
<td>Audit assessment for validity and reliability • Inter-rater assessment for validity and reliability • Member check for validity and</td>
</tr>
</tbody>
</table>
| Phase 3 (Design Study) | • Qualitative analysis of online notes  
• Quantitative analysis of online notes (ATK)  
• Questionnaires (students and mentors)  
• Informal discussion (with students and instructor-participant)  
• Observations  
• Field notes  
• Reflection on constraint analysis | • Qualitative analysis of online notes  
• Quantitative analysis of online notes (ATK)  
• Member verification (questionnaire)  
• Questionnaires (students)  
• Informal discussion (with students and instructor-participant)  
• Observations  
• Field notes  
• Reflection on constraint analysis |

The bulk of the research was carried out as part of Phase 2 (the modified Cognitive Work Analysis) and Phase 3 (the Design Study). Therefore, the following sections will focus on elaborating these data collection and analysis procedures only. For a brief description of the analysis and findings of Phase 1, refer to Chapter 1.

**The Cognitive Work Analysis**

The following section describes the data collection and analysis procedures carried out as part of Phase 2 of the research. Since the bulk of the design work involved in Phase 3 of the research relies heavily on the outcomes of the CWA, this section will also elaborate on the way that the analysis of the CWA data was carried out, including a
description of the verification procedures followed by the researcher to ensure validity and reliability of the content analysis.

Data Collection

The following sections describe each of the types and purposes of the data collected during Phase 2 of the research.

Documentation Analysis

Throughout Phase 2 of the study, the researcher was given access to annual MA-T program documents including: timetables, lists of instructors, student expectations, course outlines, course curriculum, assignment descriptions as well as copy of the most recent accreditation proposal for the program. The researcher also had access to public documents such as: the MA-T program website and the university bulletin describing the program, its admission criteria, and program expectations.

The primary purpose of the documentation analysis in this research was to give the researcher a sense of the overall design of the MA-T program, or the Work Domain (Naikar, Hopcroft and Moylan, 2005; Vicente, 1999). Through this analysis the researcher gained information about the purpose of the program, its overall structure, its primary goals and objectives, acceptance criteria for student admittance into the program, and the basic roles and expectations of faculty, students, and practicum teachers.

Stakeholder Interviews

Beginning in June of 2006, the researcher began conducting the CWA interviews. Students and faculty members - two, who also held senior administrative positions for the MA-T program - were asked a series of questions about the program and their role within it (Appendix E and F). Each interview followed a semi-structured format, and lasted
approximately 45 to 75 minutes. The interviews were digitally recorded, with the consent of the interviewees, so that they could later be transcribed for analysis purposes.

The stakeholder interviews are one of the primary sources of data for the human factors constraint analysis. Through these interviews, the researcher is able to gain extensive information about day-to-day life in the program for students and faculty, information about stakeholders’ personal goals and priorities that impact their work in the program, as well as a sense of how individuals and groups work together to accomplish goals in the program. Also, the interviews sometimes highlighted problems that stakeholders noticed within the program, including around the major research projects that students carry out in their second year, which was a main focus of the design in Phase 3.

**Questionnaires**

The researcher distributed two student questionnaires which informed Phase 2 of the research; one at the beginning of Year 2 (2006-2007) (Appendix G), and one at the beginning of Year 3 (2007-2008) (Appendix H). Parts of the questionnaire that pertained to technological competencies were based on a survey developed by Ross, Hogaboam-Gray and Hannay (1999), and parts of the questionnaire that pertained to beliefs about the use of technology in teaching were based on a survey developed by Brush, Glazewski, Rutowski, Berg, Stromfors et al. (2003). These questionnaires were used to triangulate information from other data sources (such as the interviews) pertaining to things like: students’ experiences in the program, their prior experiences with technology and their prior experience with carrying out research. Furthermore, the questionnaire administered at the beginning of the year in 2007-2008 also included a series of questions which were
used to: 1) provide support for the comparability of the student cohort between Year 2 and Year 3 of the research, and 2) verify human factors constraints that pertained directly to the design in Phase 3. Therefore, the student questionnaires are slightly different between Year 2 and Year 3.

Faculty were also given a questionnaire at the beginning of Year 2 to triangulate information gathered from other data sources about the program, their experiences with using technology in their teaching, and their prior experiences with supervising the MA-T student research projects (Appendix I).

**Observations and Field Notes**

Throughout the study, the researcher made observations and conducted informal conversations with various stakeholders, which were recorded in the researcher’s field notes. Observations and informal discussions took place throughout Phase 2 and Phase 3 of the study, and were used to support: 1) triangulation of other data sources used to generate the human factors constraint analysis, 2) record information about new constraints that emerged throughout the design study, and 3) record information about the outcomes of the design study (Phase 3).

**Informal Discussion with Primary Instructor-Participant**

Ongoing discussions with the primary instructor-participant played a critical role throughout all three Phases of the research. However, during Phase 2 - in addition to participating in the CWA stakeholder interview - the instructor-participant assisted the researcher with getting access to key stakeholders, in addition to directing the researcher to key documents that could support the human factors constraint analysis.
Content Analysis of Stakeholder Interviews and Other Data Sources

The audio files from the stakeholder interviews were transcribed using a digital transcription program called Transcription Buddy (© High Criteria). The student interviews were transcribed by the researcher and verified by an external auditor to ensure the correctness of the audio-to-print translation. In order to allow the researcher to carry on with the content analysis of the transcripts, the faculty interviews were given to an external transcriber to be completed. The external transcriber was asked to sign a confidentiality agreement with the researcher (Appendix J) to ensure the anonymity of the participants involved and to ensure that the data would remain secure. Once the transcripts were complete, the researcher verified the correctness of the audio-to-print translations.

The transcripts were then used to perform a content analysis using the five Human-Tech constraint categories proposed by Vicente (2003) - Political, Organizational, Team, Psychological and Physical. The transcripts were first coded using NVIVO v2.0 (© QSR International), a software for qualitative analysis purposes. Once each transcript was fully coded, the researcher ran a search report for each of the five categories (‘nodes’) and these excerpts were used to create a ‘constraint analysis table’. The first column of the table indicated the category to which the interview excerpt was assigned. In the second column, each constraint was given a ‘constraint description’, consisting of approximately one or two sentences. The third column of the table indicated the data sources that were used to support the creation and assignment of the constraint. The data sources primarily consisted of excerpts from the Cognitive Work Analysis interviews however, many also include researcher field notes and/or questionnaire data.
Verification Procedures for the Human Factors Constraint Analysis

The researcher conducted two external verifications on the human factors constraint analysis (constraint analysis): first, an audit was performed on the constraint analysis and second, an inter-rater assessment was performed on the assignment of the constraint descriptions to a constraint category. Verification procedures also included a member check on the student constraints that had direct design implications in the study. Each is described in more detail below.

External Auditor

Once the constraint analysis table was completed, it was given to an external auditor to be reviewed for conceptual rigor and consistency. The external auditor is considered to be an expert in Cognitive Work Analysis and its application in an educational context however, she was not involved directly with the current research study, or with the MA-T program.

The auditor was asked to assess two elements of the constraint analysis table: first, for the conceptual soundness of the constraint descriptions to the data sources (i.e., to make sure the descriptions made sense with the data sources it was meant to describe) and second, for reasonableness and consistency of the assignment of the constraint descriptions to the five Human-Technology categories (i.e., to make sure the descriptions matched the appropriate constraint category). After close review of the constraint analysis, the external auditor concluded that the constraint categories and constraint descriptions were consistent with her understanding of Cognitive Work Analysis and its application in an educational research context. When the auditor had noted a concern and/or question regarding the constraint category and/or description, this was dealt with
through a process of negotiation between the researcher and auditor, and where necessary, changes were made to the constraint analysis table to satisfy the concerns of the auditor and improve the overall soundness and consistency of the content analysis.

**External Rater**

Once the external audit was completed, the constraint descriptions were given to an external rater to be checked for consistency. The external rater was not familiar with Cognitive Work Analysis, however he has approximately seven years of experience working in a university academic setting (including in a teacher education context), where he was involved in teaching and program evaluation.

The constraint descriptions were randomly sorted and the rater was asked to assign each description to one of the five constraint categories. Prior to rating the constraint descriptions, the rater was given a brief training session to understand the definitions of each of the categories (Appendix K). He was then given a table of ten contextually-relevant, yet fictitious, constraint descriptions to practice assigning them to a category (Appendix L). The rater achieved 90% accuracy on the practice data set. The rater was then given time to work with the actual data set, to assign each of the constraint descriptions to a category. This process took approximately four hours to complete.

Once the ratings were completed, the data set was given back to the researcher and was used to enter the categories into a Microsoft Office© Excel spreadsheet and measured for inter-rater reliability against the researcher’s categories. Initial inter-rater reliability was calculated at 73% agreement. The researcher and rater met again to discuss the discrepancies in coding the constraint categories. After negotiation, inter-rater agreement increased to 97%. Where necessary, changes were made to either the
constraint category or the constraint description to satisfy the concerns of the rater and improve the overall soundness and consistency of the content analysis. The remaining 3\% of discrepant constraint categories and/or descriptions (a total of ten constraints) were kept in their original form. Six of the ten remaining constraints dealt with the same categorization conflict (Psychological-Physical) between the researcher and the rater in which the stakeholder (interviewee) is commenting on the place(s) that they typically carry out their work; the rater saw this as emphasizing personal choice (Psychological), whereas the researcher wanted to emphasize the distribution of space in which work is typically carried out (Physical) in the system (i.e., stakeholders do not always share a common workspace).

\textit{Member Check}

A member check was performed for the student constraints that ultimately had design implications in the study. Due to the length of time it took for the researcher to acquire all of the participants willing to be interviewed, arrange mutually convenient meeting times to carry out the interviews, conduct the interviews, complete the transcription process and verify the audio-to-print translation (approximately one year from start to completion) it would not have been feasible to access the original participant interviewees to perform a member check; these students had already graduated from the program. Furthermore, the time delay between the original interview and the member check would have been of such length as to question the reliability of the results of a traditional member check. However, the researcher believed it was important to carry out a member check to the extent possible, given these limitations, especially for the student constraints since they represented only one third of the total student stakeholder group,
and also since it would be important to ascertain the consistency of the student constraints from year to year as new students enter the program.

The 10 student constraints that had direct design implications in the study were written as opinion statements and distributed in the form of a questionnaire to students in the 2007-2008 academic year (as part of the questionnaire at the beginning of the year—see Appendix H). Students were asked to rate their level of agreement with the statements on a Likert scale (strongly disagree to strongly agree). The level of agreement indicated by the respondents was used to suggest the strength of the validity and reliability of each constraint.

A total of 20 students from the 2007-2008 academic year responded to the questionnaire (participant response rate = 52.6%). Responses indicating the levels of agreement (strongly agree, agree, somewhat agree) were collapsed into one ‘agree’ category, and responses indicating the levels of disagreement (strongly disagree, disagree, somewhat disagree) were collapsed into one ‘disagree’ category, in order to calculate the overall level of agreement for each constraint. Responses indicating ‘not sure’ in response to the statements were left as is. Member agreement on each of the 10 constraints ranged from 83% to 96%. The total agreement across all constraints was 90%.

**The Design Study**

Phase 3 of the research involved carrying out a design study based on information gathered from the CWA in Phase 2. The design study consisted of two major innovations. The end to Innovation 1 was marked by the completion of the 2006-2007 academic year, and the beginning of Innovation 2 was marked by the start of the 2007-
2008 academic year. The data collection and analysis procedures for the design study are described below.

**Data Collection**

**Questionnaires**

There were two student questionnaires administered in each year of the design study. The questionnaire at the beginning of each year was primarily used to triangulate information for the CWA (Phase 2). The end-of-year questionnaire requested feedback from students regarding the innovations in the study (Phase 3) (Appendix M and N). These questionnaires are slightly different in some sections between Year 2 and Year 3, in order to address feedback that reflected the unique attributes of the design between the two Innovations.

Two questionnaires were also distributed as part of Phase 3 to five doctoral students who participated as research mentors in the design study during the 2006-2007 academic year. The first questionnaire was given to the mentors at the beginning of Innovation 1 to collect information about their backgrounds in teaching and research (Appendix O), and another questionnaire was given to the mentors at the completion of Innovation 1 of the study to request their feedback regarding the innovations in the study (Appendix P).

**Qualitative Analysis of Online Notes**

As part of the design study, participants (students and mentors) engaged in discussion in an open online research support forum (run using Knowledge Forum®). The researcher performed a content analysis of the notes from each year, using Creswell’s (2008) Steps in Conducting Research. For each year, the researcher provides a
summary of the ways in which the students and mentors tended to use the open online research support forum to engage in discussion around the major research projects that students carry out as part of the MA-T program.

**Quantitative Analysis of Online Notes**

The researcher used the Analytic Toolkit (data analysis tool in Knowledge Forum®) to gain information about students levels of participation in the open online research support forum.

**Informal Discussion**

Throughout the design study, the researcher engaged in informal conversations with stakeholders in order to get a sense of how they perceived the open online research support forum, and also to inform design perturbations that could reasonably be carried out during the Innovations. Design perturbations were made in consultation with the primary instructor-participant.

**Observations and Field Notes**

Throughout the study, the researcher made informal observations (e.g., during the face-to-face component of the Psychology course, after meetings or email exchanges with mentors) which were recorded in the researcher’s field notes. Observations and field notes were used to support analysis of the outcomes of the design study, and to inform design perturbations during the Innovations.

**Reflection on Constraint Analysis**

The human factors constraint analysis that was performed as part of Phase 2 of the research was used to support design decisions, perturbations during the Innovations, as well as reflection upon completion of each Innovation of the design study. In addition to
providing information about the context, the constraint analysis also provided the researcher with the means with which to organize and prioritize design decisions, and to support discussions with the primary instructor-participant throughout the study.

**Analysis of the Design Study**

Data collection that occurred during Phase 3 of the research was used to triangulate analysis of the outcomes of the design study. The analysis of the outcomes of the design study centered on the following primary research question: What is the impact of an open online research support forum, designed using a Human-Tech framework for technology integration, on students’ experiences in carrying out research as part of their initial teacher preparation in the context of a two-year graduate level teacher education program?

Analysis of students’ experiences are measured in terms of the following guiding questions, which reflect issues identified around the student research projects in Phase 1 (problem identification) and Phase 2 (Cognitive Work Analysis) of the research:

1. How did students ultimately use the open online research support forum?
2. To what extent did the open online research support forum scaffold students’ ability to collaborate with others around their research?
3. What was the perceived impact of the open online research support forum for the MA-T students?
4. What was the perceived impact of the open online research support forum for the mentors involved in Innovation 1 of the design?
A combination of qualitative and quantitative data is used to support analysis for each of the guiding questions above. In Chapter 5 and 6, the results are reported according to these questions, for each of the two Innovations of the design study respectively.

Summary

This chapter clarified the timeline of the study, the context of the study, the participants, the data collection methods employed across a three-year period, and the methods of data analysis used. The research is divided into three phases: Phase 1) Problem Identification, Phase 2) Cognitive Work Analysis, and Phase 3) the Design Study.

There are three main questions explored in this research:

Question One

What does a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, reveal about the system constraints of a two-year graduate level teacher education program?

Question Two

What are the technological design implications of a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, for supporting student research in the context of a two-year graduate level teacher education program?
**Question Three**

What is the impact of an open online research support forum, designed using a Human-Tech framework for technology integration, on students’ experiences in carrying out research as part of their initial teacher preparation in the context of a two-year graduate level teacher education program?

For research question three, there are four guiding questions which reflect issues identified around the student research projects in Phase 1 (problem identification) and Phase 2 (Cognitive Work Analysis) of the research:

3.1. How did students ultimately use the open online research support forum?

3.2. To what extent did the open online research support forum scaffold students’ ability to collaborate with others around their research?

3.3. What was the perceived impact of the open online research support forum for the MA-T students?

3.4. What was the perceived impact of the open online research support forum for the mentors involved in Innovation 1 of the design? [Addressed in Innovation 1 only]

In the next chapter (Chapter 4) the researcher will report the results of the CWA and its implications for design in Phase 3 of the research. In Chapter 5 and 6, the researcher will report the findings from Innovation 1 and Innovation 2 of the design study respectively.
CHAPTER FOUR: RESULTS OF THE COGNITIVE WORK ANALYSIS

This chapter describes the results of the modified Cognitive Work Analysis (CWA) - Phase 2 of the research - that was implemented in the context of a two year graduate level teacher education program (MA-T). The CWA was implemented as a means of examining the use of a Human-Tech (Vicente, 2003) framework for understanding technology design and integration in which socio-contextual factors, or constraints, are directly applied as criteria for informing design decisions. The bulk of the data collection for the CWA occurred from June to October of 2006. In June of 2006, the researcher began documentation analysis and stakeholder interviews with faculty in the MA-T program. In September 2006, the researcher began student stakeholder interviews and administered questionnaires to faculty and students. Information from all data sources was then compiled into a human factors constraint analysis, which is the focus of this chapter.

The chapter begins by examining the overall results of the modified CWA. Next, the researcher discusses the implications of the CWA, and specifically, the 24 constraints that are addressed as part of the design study that followed (Phase 3) - which is reported in Chapters 5 and 6 of this document. The chapter concludes with a description of an open online research support forum - the Online Research Mentorship - that was designed to address these 24 constraints.

Research Questions Guiding the CWA

The researcher addresses the first two (of three) research questions guiding the overall investigation reported in this document. These questions are:
Question One

What does a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, reveal about the system constraints of a two-year graduate level teacher education program?

Question Two

What are the technological design implications of a Human-Tech approach to technology integration, implemented through the use of a modified technology design tool called Cognitive Work Analysis, for supporting student research in the context of a two-year graduate level teacher education program?

Overall Results of the Human Factors Constraint Analysis

Once verification procedures for the content analysis of the CWA data had been completed and adjustments had been made to satisfy any auditor-researcher and/or rater-researcher disagreements, there were a total of 358 human factors constraints identified in the context of the two-year MA-T program. Using Vicente’s (2003) Human-Tech categories as a framework for the content analysis, 30 human factors were found to pertain to Political constraints, 100 pertained to Organizational constraints, 82 pertained to Team constraints, 125 pertained to Psychological constraints, and 21 pertained to Physical constraints. Faculty and student data was analyzed separately and then merged into one human factors constraint table. Table 5 summarizes the distribution of the constraints across each group.
Although it appears that the faculty data had nearly six times the number of constraints, it should be noted that the student data was summarized into one constraint analysis based on all 8 students interviewed (plus other data sources), whereas the faculty data was analyzed for each individual faculty member interview (plus other data sources). The reason for this is that students’ data was easily compiled since student stakeholders tended to have similar responses to the CWA interview questions, whereas the 6 faculty stakeholders tended to have very different responses to the CWA interview questions, making a compilation difficult. Therefore, the researcher made the decision to run these analyses separately in order to preserve the complexity of the dissimilarities in responses, since this could also lead to insights into the overall structure of, and activity within, the MA-T program.

**General Description of the MA-T Program Based on Results from the CWA**

The functional purpose (Naikar, Hopcroft and Moylan, 2005) of the MA-T program is to provide preparation for teacher licensure in Ontario in addition to academic study in education over a two-year period. The preparation for teacher licensure component of the program runs like many other Bachelor of Education programs (typically 8 or 9 months in Ontario); students take courses such as teaching methods,
curriculum, classroom management, and they also participate in classroom-based observation and practice teaching in the form of a practicum placement (placement in a K to 12 school). The academic component of the program functions similarly to other Master’s level programs; students take graduate-level courses, and complete a comprehensive requirement which typically takes the form of an essay, a presentation and/or a research project. In the MA-T program, most of the teacher preparation requirements are completed during year one of the program and most of the academic requirements are completed during year two.

The MA-T program is designed based on a cohort-model framework in which a relatively small number of students (usually under 50) go through their entire program - or nearly the entire program - with the same peer group; starting and finishing the program at the same time. In the MA-T program, there are two cohorts (year one and year two) and there is typically less than 50 students in each cohort (less than 100 students in total), and only a small number of faculty and practicum schools. One new cohort of students is accepted each year as one cohort graduates, so that there are always two cohorts in any given academic year.

Currently, in the teacher preparation component of the program students are required to take teaching foundations courses in addition to completing four practicum placements (two in each year of the program). Students are prepared for teacher licensure in the primary-junior (PJ) or junior-intermediate (JI) divisions (both are considered elementary-level education). In the academic component of the program students are required to take graduate foundations courses, in addition to completing a comprehensive exam which is comprised of two parts: a philosophy of education presentation and a
research project. Students take 16 half courses in total (14 required, and 2 electives) as part of the program, over two years; the comprehensive requirement is done in addition to these courses.

The MA-T program officially began in 2000 after a two-year pilot study that explored the logistics of creating a two-year teacher preparation program as an alternative to the more common 8- or 9-month model. Initially, the program was run out of two departments in the same institution (Curriculum and Psychology) - with two program coordinators - but within a couple of years it was run completely out of one department (Curriculum) - with one program coordinator. One of the changes that resulted from this Organizational shift was that the student research requirement was no longer a full Master’s thesis - or MRP (Major Research Paper) - and instead became a research ‘project’. As such, students were also no longer required to take a traditional ‘research methods’ course, and they did not need to complete a full ethical review as an independent researcher.

Instructors in the MA-T program are made up of full-time faculty, and contract faculty; some also teach in other graduate level and teacher education programs. The faculty currently meet regularly throughout the year (approximately 3 or 4 times), although most of them admit that they do not often work together on program development or course development. In the seven years that the program had been running at the time of the CWA interviews, there had been five transitions to the position of coordinator (the person that oversees the program) and the current coordinator had held the position for one year. A few faculty members have been part of the program
since the first or second year that it began (among those interviewed) however, there are some others who have joined the program’s faculty more recently.

Students in the program are typically in their mid to late twenties and have completed a four-year bachelor’s degree, with at least a mid B or better standing in their last year of study. Each year, there are typically more applicants than can be accepted into the program, and as such, the students who are selected tend to be relatively ‘high calibre’ (e.g., typically receive high grades, wide variety of experience working with children, a few have completed an undergraduate thesis).

**Problem Identification**

In Phase 1 of the research, the researcher identified a problem in the MA-T program which focused on the student research projects. Informal conversation with stakeholders in the program had suggested that students did not feel they were sufficiently supported in carrying out their research projects, and the quality of the research in many cases was below what is normally expected within an academic program. Informal observation indicated that students primarily carry out their research independently, although they have some access to a research supervisor; the extent of this access varied considerably from none to regular access. Students mainly accessed their research supervisor through face-to-face meetings and/or email, although most had little to no contact with their supervisor during practicum (when data is typically collected). Furthermore, students did not tend to collaborate with their peers around their research; many did not know what others were working on, even when the problems they were working on (research topics) may have been similar or related.
The problem around the research projects in the MA-T program - in addition to broader problems of technology integration in support of learning in teacher education identified through a literature review - provided the main impetus for carrying out the modified CWA (Phase 2), and the eventual design of the open online research support forum as part of the design study (Phase 3). The remainder of the chapter discusses the specific design implications of a sub-set of constraints from the human factors constraint analysis, that lead up to Phase 3.

**Design Implications of the Human Factors Constraints**

Although all of the human factors constraints identified are likely to have an impact to some degree on any design, the researcher decided to focus only on a small number given the scope of the study. The following section describes the 24 human factors constraints that were addressed in the design study (Phase 3), their design implications and the specific design strategies taken by the researcher in Innovation 1. In total, 14 of the faculty constraints, and 10 of the student constraints were addressed (6 Organizational constraints, 5 Team constraints, and 13 Psychological constraints). These constraints represent approximately 6.7% of the total constraints identified.

**Selecting the Constraints to be addressed in the Design Study**

The researcher contends that it would not be feasible - at least initially, and within the scope of this research - to take all 358 constraints into account in the design study. Therefore, the researcher used three main criteria for deciding which of the constraints to address in the design study:

1. Relevancy of the constraint
The first criteria used for judging whether a constraint would be addressed as part of the design study was whether or not it was thought to have any direct bearing on the problem that the researcher was trying to solve (i.e., it had some connection to the student research or to technology). Although it can be assumed that all the constraints identified have an impact on the problem to some degree, only those having to do with the student research and/or technology were initially considered as potential design criteria. There were approximately 149 constraints that dealt specifically with the student research and/or use of technology in the program.

2. Relative importance of the constraint

Since the researcher thought it would not be feasible to take 149 constraints into account in the design study, the second criteria the researcher used for judging whether a constraint would be addressed, was how important the constraint was thought to be to the problem that the researcher was trying to solve. As mentioned, although all of the constraints likely have an impact on design to some degree, the key for the researcher was to decide which ones ought to be brought to the fore as design criteria.

3. Likelihood of impact

The final criteria for judging whether a constraint would be addressed in the design study, was the degree to which the researcher thought she would be able to have an impact on that constraint through the design process. For example, it may be more difficult for the researcher to have an impact on an Organizational constraint, such as whether or not the student research should qualify as a thesis, than on a Psychological constraint, such as students’ levels of competency with carrying out research. In other words, the researcher would be more likely to be able to design supports to take into
account - and potentially improve - students’ ability to carry out research, than to change the design of the MA-T program itself, and how the research is structured within it (although this has some implications for the design study, which is reported in subsequent chapters).

**The Human Factors Considered in the Design Study**

In total, 24 human factors constraints became the focus for design; 6 Organizational constraints (constraints describing things like program priorities, objectives, stakeholders’ roles), 5 Team constraints (constraints describing how groups of stakeholders work together to achieve goals and priorities within the program), and 13 Psychological constraints (constraints describing such things as individual competencies, skills, personal priorities, perceptions). For a complete description of these constraints, their design implications and the specific design strategies that each informed, see Appendix Q.

**Innovation 1: The Online Research Mentorship (ORM)**

Based on the problem identified in Phase 1 of the research, and design implications from the 24 constraints selected for the design study, the researcher designed an online research mentorship (ORM) to help support students’ work related to their research projects as part of the MA-T program. While the researcher kept other constraints in mind during the design, the 24 constraints mentioned above were the primary focus in the design study.
Technological Design

The ORM was supported through an online discussion forum technology called Knowledge Forum®. This software was designed to support a knowledge building pedagogy (Scardamalia, 2002) and has many features that can be used to engage in collective forms of inquiry. However, the researcher had a lot of flexibility in deciding which components of the program would be used, and ultimately what the inquiry workspace would look like. The following sub-sections describe the ways that the researcher designed the online space of the ORM.

Online Research Groups

The Knowledge Forum® software was used to create a shared space in which small numbers of students could work in online research groups on the research they were carrying out - most of which is classroom-based research. The small research groups were made up of second year students from the MA-T program, who were working on similar or related problems for their research projects as part of their initial teacher education. Each online research group also had a doctoral research mentor - an experienced educational researcher - that had volunteered to help support the students through the process of carrying out their research, and to encourage ongoing discussion related to the common area of interest in which the students were working. Although the online mentorship primarily focused on the small research groups, the open design of Knowledge Forum® also allowed students to access and contribute notes in other research groups. Therefore, in the ORM students could read all notes posted by their peers, both within and outside their research group. Students could also respond to any note in the ORM. The goal of the small research groups was to encourage students to
collaborate with their peers around common, or related, problems. However, the purpose of leaving the research groups open to others to read and contribute notes, was to also encourage students to see the work they were doing as related to the work that others were doing in the context of the larger learning community.

**Email Notifications**

Knowledge Forum® comes equipped with an email notification system that can be programmed to send an email message to individuals in the ORM when new activity occurs (i.e., a note is posted or edited by one of the members). The researcher programmed the email notifications to be sent out every 24 hours, if there was new activity in the research groups. These notifications were sent to the research group members and to all the mentors, and they summarized new activity across all of the research groups. In these notifications, students and mentors would see the title of the note, the name of the person that posted it, the date it was posted, and a small excerpt (approximately 30 to 40 words) of the note. Individuals could then connect to the ORM directly from the email notification if they wanted to continue reading the contents of the note. The goal of the email notifications was twofold: 1) to encourage students to read notes of other members of their research group, and also other research groups if applicable to their own work, 2) to serve as a reminder of the overall research work that was happening within their learning community.

**Pedagogical Design**

Some of the design strategies that the researcher adopted for supporting work around the students’ research projects pertained to pedagogy, rather than technology. The instructor-participant in the design study was the instructor for Psychology, which is one
of the required, or core, courses that students are expected to take during their second year in the MA-T program. The instructor and the researcher collaborated with one another to create course-based supports for the students’ research that could also tie into the content of her course, based on what was known through the CWA. The main objective for the instructor and the researcher was to create course-based supports that would tie into the larger goals of the MA-T program, specifically the students’ research projects.

**Mini Research Summaries**

One of the designs that the instructor and researcher implemented was a research assignment in which students would submit mini summaries of each component of their research project (i.e., topic, literature review, method, etc.). One mini summary was to be submitted approximately every month, and could include connections to principles of learning that the students were covering in their course. For example, the mini literature review might include a section on how a particular learning theory has informed their research topic. Students could then submit their summaries to the ORM (since the ORM could be accessed directly from the course discussion forum - also Knowledge Forum®) for instructor feedback and grading, and as an opportunity for additional formative feedback from their mentor. The goal of this assignment was threefold: 1) the monthly due dates were meant to help students think about and work on their research project in small sections over time, rather than leaving it until the end of the year, 2) to give students regular feedback on their ideas related to their research and 3) to provide an opportunity for students to consider how their research connected to the larger body of literature on learning and development (which was covered in the course).
**Research Conference**

The second strategy developed by the researcher and the instructor was to hold a research conference at the end of the year, in which students could present a short summary of their research to their peers, the mentors and faculty from the MA-T program. Prior to the design study, students in the MA-T program had never had the opportunity to present their completed research to their peers and faculty. Each student was responsible for preparing a five-minute presentation and a short abstract summarizing their project and findings. The objective for the researcher conference was twofold: 1) to give students the opportunity to share (and celebrate) their research with the broader MA-T community, and their mentors, and 2) to emphasize the importance of dissemination as part of academic practice around research. Students were also given copies of a proceedings booklet that contained all of the research abstracts from the projects that students had completed over the year.

**The Students**

During Innovation 1 of the design study, there were 23 student participants. These students were enrolled in their second year of a two-year graduate level teacher education program, which focuses on the field of Curriculum and Teaching (MA-T). At the beginning of the year, students were asked to fill out a questionnaire related to their background in research and technology. Nearly a third (30.4%) of the students said that they had no prior experience with conducting research. All 23 students had access to a computer and the Internet from home, and the majority said that they used a computer, the Internet, and email often. Slightly more than half (52.2%) said that they also participated in online discussion (chat rooms, discussion forums) often.
The Mentors

The 6 mentors in the design study were graduate students enrolled in a doctoral program in education (one of which was also the researcher for the current study). Three of these mentors were also classroom teachers, and the other three had some university-based teaching experience. The researcher invited the students to participate as mentors on a volunteer basis, in exchange for an opportunity to gain experience with teaching and guiding student research; things they would be expected to do as future academics although received little formal opportunity to do as part of their doctoral training.

Introducing the ORM to Students

The students were introduced to the ORM through their Psychology course, as part of their training on how to use the Knowledge Forum® (which they were already expected to use as part of their Psychology course). From their course discussion forum, there was a direct link to the ORM online research groups. On the first day of their Psychology course - there were 12 classes altogether - the students were asked to contribute a note to their class discussion forum that summarized their initial ideas about the research they would like to carry out; this also provided practice with using the Knowledge Forum® software. The researcher provided 5 questions to prompt students’ descriptions about their research, and research experience:

1. Do you have any prior experience with carrying out a research study? Please specify.

2. What area of interest are you planning to investigate as part of your MT research project?

3. Do you have specific research questions in mind yet? Please specify.

4. What do you think are the benefits and drawbacks to doing teacher research (action research)?
5. Is there anything specific that you think you will need help with over the coming year to help you with carrying out your research project?

These questions were then used to form the small research groups, based on the relative proximity of interests among the students. The researcher then sent the list of research group topics to the mentors and asked them to select their top three choices for which group they would like to work with; to the best of the researcher’s ability, the mentors were given either their first or second choice. The researcher also asked each of the mentors to post an introductory note in their online group, describing their research background, research interests, personal information, etc. The researcher provided the following 3 topic headings to prompt their descriptions:

1. Education and Work Background
2. Research Interests
3. Personal "Tidbits"
4. Things I wish I had known when I started my research...

Conversation in each of the online research groups began with the initial note posted by the students.

Summary

This chapter describes the results of the modified Cognitive Work Analysis (CWA) - Phase 2 of the research - that was implemented in the context of a two year graduate level teacher education program (MA-T). The chapter begins by examining the overall results of the modified CWA, in which 358 human factors constraints were identified in the context of the MA-T program. Using Vicente’s (2003) Human-Tech
categories as a framework for the content analysis, 30 human factors were found to pertain to Political constraints, 100 pertained to Organizational constraints, 82 pertained to Team constraints, 125 pertained to Psychological constraints, and 21 pertained to Physical constraints. Next, the researcher discusses the implications of the CWA, and specifically, the 24 constraints that are addressed as part of the design study that followed (Phase 3) - which is reported in Chapters 5 and 6 of this document. The chapter concludes with a description of an open online research support forum - the Online Research Mentorship - that was designed to address these 24 constraints.

The following chapter reports on the results of the Online Research Mentorship, which was designed using these 24 human factors constraints.
CHAPTER FIVE: RESULTS OF INNOVATION 1

The preceding chapter describes the results of a modified approach to Cognitive Work Analysis (CWA) (Vicente, 1999) that was implemented in the context of a two year graduate level teacher education program (MA-T). Using the human factors constraint analysis, developed from the data collected during the CWA phase of the study (Phase 2), the researcher outlined technological and pedagogical design implications for supporting MA-T students in carrying out their major research projects - which is a major component of their initial teacher training. In this chapter, the researcher outlines the results of Innovation 1 of the design study (Phase 3 of the research), carried out during the 2006-2007 academic year.

The open online research support forum took the form of an Online Research Mentorship (ORM) in Innovation 1 of the study. For a full description of the ORM, see Chapter 4.

Research Questions Guiding Innovation 1

Data from the CWA was used to inform three underlying objectives for supporting the students’ research, and for designing the open online research support forum: 1) to provide personal, ongoing assistance to students while carrying out their research, 2) to encourage students to actively work on and discuss their research throughout the year, and 3) to encourage students to collaborate with others - in particular, their peers - around their research topics. The main research question addressed in this chapter is: What is the impact of an open online research support forum (i.e., the Online Research Mentorship), designed using a Human-Tech framework for
technology integration, on students’ experiences in carrying out research as part of their initial teacher preparation in the context of a two-year graduate level teacher education program? There are four guiding questions that the researcher uses to answer this research question:

1. How did students ultimately use the online research mentorship?
2. To what extent did the online research mentorship scaffold students’ ability to collaborate with others around their research?
3. What was the perceived impact of the online research mentorship for the MA-T students?
4. What was the perceived impact of the online research mentorship for the mentors involved?

Use of the Open Online Research Support Forum (ORM)

This section begins by describing the overall outcomes related to the students’ and mentors’ use of the online research mentorship (ORM). Next, using Creswell’s (2008) Steps in Conducting Research, the researcher will provide a qualitative description of the specific ways that the ORM was used by referencing examples from student and mentor notes in the ORM. The researcher will also describe, using quantitative measures from the Analytic Toolkit in Knowledge Forum®, how the ORM was used by both students and mentors. Lastly, the researcher will conclude this section with a look back on the human constraint analysis (Chapter 4), to add further insight into the outcomes related to use of the ORM.

Overall Structure of the Use of the Mentorship

During the 2006-2007 academic year there were approximately 136 notes contributed to the ORM, and 515 reads (number of notes read by all students and mentors). Content analysis of the notes, using Creswell’s (2008) Steps in Conducting
Research, suggests that the majority of the notes focused on identifying a research problem, reviewing the literature, specifying a purpose for the research (including forming specific research questions), and collecting data.

In general, the students’ use of the ORM differed with respect to how much, and how often they contributed and read notes. Eight of the 23 participants did not contribute any notes beyond the first initial note that they were requested to post during the first week of the design study (to provide the mentors with a brief description of their research interests). However, these 8 students continued to read notes that were posted to the ORM - both within their own research groups and in other research groups. Fifteen of the 23 student participants both contributed and read notes throughout the year. Of the 15 students who contributed and read notes, on average, students created 4 notes (range, 1 to 11 notes) to the ORM and read 10 notes (range, 3 to 33 notes) over the course of the year. Some of the students continued to contribute notes over the entire year, whereas others contributed notes on only one or two occasions. The average number of notes read by non-contributing students was 3 notes (range, 1 to 11 notes). The mentors in the ORM contributed, on average, 13 notes (range, 7 to 26 notes) and read 44 notes (range, 9 to 113 notes).

**Supporting Steps of the Research through the ORM**

The researcher used the Steps in Conducting Research (SCR) described by Creswell (2008), to guide a qualitative analysis of the notes contributed to the Online Research Mentorship (ORM) in Innovation 1 of the design study. The SCR is outlined in Table 6, which is adapted from Creswell (2008).
<table>
<thead>
<tr>
<th>Step</th>
<th>Description of Step</th>
<th>Definition of Step</th>
<th>Targets for Research Steps Identified by Creswell (2008, p.8)</th>
</tr>
</thead>
</table>
| Step 1 | Identifying a research problem | “Identifying a research problem consists of specifying an issue to study, developing a justification for studying it, and suggesting the importance of the study for select audiences” (p. 8). | • Specifying a problem  
• Justifying it  
• Suggesting the need to study it for audiences |
| Step 2 | Reviewing the literature | “Reviewing the literature means locating summaries, books, journals, and indexed publications on a topic; selectively choosing which literature to include in your review; and then summarizing the literature in a written report” (p. 9). | • Locating resources  
• Selecting resources  
• Summarizing resources |
| Step 3 | Specifying a purpose for research | “The purpose for research consists of identifying the major intent or objective for a study and narrowing it into specific research questions or hypotheses” (p. 9). | • Identifying the purpose statement  
• Narrowing the purpose statement to research questions or hypothesis |
| Step 4 | Collecting data | “Collecting data means identifying and selecting individuals for a study, obtaining their permission to study them, and gathering information by asking people questions or observing their behaviour” (p. 10). | • Selecting individuals to study  
• Obtaining permissions  
• Gathering information |
| Step 5 | Analyzing and interpreting the data | “Analyzing and interpreting the data involves drawing conclusions about it; representing it in tables, figures and pictures to summarize it; and explaining the conclusions in words to provide answers to your research questions” (p. 10). | • Breaking down the data  
• Representing the data  
• Explaining the data |
| Step 6 | Reporting and evaluating the research | “Reporting research involves deciding on audiences, structuring the report in a format | • Deciding on audiences  
• Structuring the report  
• Writing the report |
In the case of students who chose to conduct an action research project for their major research project, Creswell (2008) mentions two additional stages in the research cycle:

Step 7: Developing an action research plan

Step 8: Implementing the plan and reflecting

It was important for the researcher to know in what ways the mentorship was being used, since it suggests which aspects of the major research projects were being supported through the online environment. Also, understanding which aspects of the research that the online mentorship supported would provide additional information about the kinds of support students need during the major research process - lending further insight into the human factors constraint analysis.

**Results from Online Notes**

In total, there were 136 notes posted to the ORM over the course of Innovation 1 of the design study. All students were asked to post an initial note to the ORM to describe their research interests, and prior experience with research to their mentor. Beyond this initial note, 15 of the 23 (65%) MA-T students continued to post notes to the ORM. Appendix R provides a description - including references from students’ notes - of how the ORM was used by both the students and the mentors, according to the previously mentioned SCR categories described by Creswell (2008). Names that appear in the excerpts from the ORM - with the exception of the researcher (Kim), who also had a role
as a mentor in the design study - have been changed to protect the identity of participants. Researcher comments appear in hard brackets.

Overall, the majority of the students’ notes tended to focus on the first four phases of Creswell’s (2008) Steps in Conducting Research; the most common conversations focused on identifying their main research problem, and specifying the purpose of their research and establishing research questions (Steps 1 and 3). Very few notes discussed data analysis or reporting and evaluating the research, and only one student carried out what could be classified as an action research study (Step 7 and 8).

**Results from Analytic Toolkit**

In total, there were 136 notes contributed to the ORM and 515 reads (notes read by students and mentors). Of the 136 notes contributed, 55 were contributed by the students, 80 were contributed by the mentors, and 1 note was contributed by the instructor-participant (the ORM was primarily overseen by the mentors). Of the 515 reads accumulated, 236 were generated by students, 262 were generated by the mentors, and 17 were generated by the instructor-participant. The participation of students, mentors and the instructor-participant are summarized in Table 7.

Table 7

*Summary of Participation (Contributions and Notes Read) in the ORM*

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Notes Created</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>Total Notes Read</td>
<td>515</td>
<td></td>
</tr>
<tr>
<td>Notes Created by Students</td>
<td>55</td>
<td>40.4%</td>
</tr>
<tr>
<td>(n=23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes Created by Mentors</td>
<td>80</td>
<td>58.8%</td>
</tr>
<tr>
<td>(n=6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes Created by</td>
<td>1</td>
<td>0.7%</td>
</tr>
<tr>
<td>Instructor-Participant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor-Participant</td>
<td>Notes Read by All Students ($n=23$)</td>
<td>236</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Notes Read by Student Contributors ($n=15$)</td>
<td>209</td>
<td>40.6%</td>
</tr>
<tr>
<td>Notes Read by Student Non-contributors ($n=8$)</td>
<td>27</td>
<td>5.2%</td>
</tr>
<tr>
<td>Notes Read by Mentors ($n=6$)</td>
<td>262</td>
<td>50.9%</td>
</tr>
<tr>
<td>Notes Read by Instructor-Participant</td>
<td>17</td>
<td>3.3%</td>
</tr>
</tbody>
</table>

Overall, students accounted for approximately 40% of the total contributions to the ORM and just under half of the reads generated. Students who contributed notes to the ORM ("student contributors") accounted for the majority of the student reads (88.6% of the total student reads), with non-contributing students accounting for only 5% of the total reads.

Results from Questionnaire Feedback

In addition to conducting a qualitative analysis of the online notes to get a sense of how the students were using the ORM, the researcher also received feedback from the students - as part of the questionnaire distributed at the end of the year - about how they tended to use the ORM. Twenty of the 23 student participants (87% response rate) responded to a question asking: “How did the online mentorship help you with the overall process of your research?” Among the most frequent responses were “Helping to come up with my research questions” (25%), “Helping to design my research method” (20%), and “Just knowing I have someone there 24-7 to go to for research assistance when I need it” (20%). These responses coincide with the researcher’s interpretation that the majority of the notes in the ORM tended to be geared towards the first four stages of Creswell’s (2008) steps in conducting research. Other responses included: “Helping to narrow down
and/or locate literature about my topic”, “Helping with my data analysis””, “Editing written work” and 1 student selected “Emotional support/encouragement to complete my research”.

**Reflecting Back on the Constraint Analysis**

In looking back at the constraint analysis (Chapter 4), there are a number of factors that may have played a role in how students ultimately ended up using the ORM. The reason why the majority of conversation in the ORM centered around the first four steps in conducting research (Creswell, 2008) could be due to the fact that most students do not get to the analysis and write up stage of their research until the end of the year. This is also tied to the fact that at the Organizational level, students are not given a lot of time to focus on independent study (including their research) throughout the year, making it more likely that work related to their research will continue right to the end of their program (April). Therefore, if students are pressured to submit their research they may be less likely to take the time to seek out feedback in the final stages of their work (i.e., analysis and write up).

Differences in levels of use of the ORM (how much and how often) could reflect a number of constraints identified in Phase 2. First, it’s possible that students’ prior experience with carrying out a formal research project could have contributed to their decision to use the ORM, and how likely they were to need assistance throughout the year. Students having prior research experience may have decided they did not need additional help outside of their research supervisor; conversely, they may also have been more likely to see value in receiving critical feedback on their ideas, therefore, making it more likely that they would participate in the ORM. Students with little research
experience may have been more likely to seek help with their research, and therefore, more likely to participate in the ORM; conversely, lack of prior experience in carrying out a formal research project may also have made students less likely to see value in receiving critical feedback on their ideas, from multiple perspectives.

Some other constraints that may have impacted use of the ORM include: whether or not they had access to a supervisor, how often they had access to their supervisor, students’ perceived value of the research project in the MA-T program, and students’ prior experience and/or perceived self competency with respect to technology. The fact that the student research projects are graded on a pass/fail basis by their faculty supervisor, may also have contributed to how likely they were to put in ‘extra work’ by getting involved with the ORM (which did not have any direct impact on their grades). Some of these factors are explored in more detail in this chapter, in the section entitled “Students’ Perceived Impact of the ORM”.

**Impact of the ORM on Collaboration around the Student Research**

Student collaboration around the research projects became an important element of the design study for a couple of reasons relating to the human constraint analysis (Chapter 4) in the MA-T program. First, the instructor-participant believes that learning happens by interacting with others, and through discussion. Through many informal conversations with the instructor-participant, it was apparent that this belief is central to her overall philosophy and approach to teaching. In general, she holds a knowledge building (Scardamalia, 2002) philosophy of teaching in which collective understanding is valued over learning in isolation from others, and in which the goal of learning is not
simply to acquire knowledge, but to aspire to transcend what is considered generally-accepted knowledge (Scardamalia, 2008). Second, the researcher wanted to leverage the existing Team factor which suggested that students often look to each other for support and advice. Furthermore, through Knowledge Forum® students would have increased access to their peers over the course of the year, including over practicum (when the bulk of their data is collected for their research), when they have little contact with the university and their cohort peers.

**Analysis of Activity within the Online Research Groups**

Each of the students was assigned to an online research group based on their self-reported research interests at the beginning of the year. The overarching problem, or focus problem area, for each of the groups was established based on the distribution of students’ research topics. Mentors were then sent the list of the six focus problem areas and asked to select their top three choices for which research group they would most like to work with. To the best of the researcher’s ability, the mentors were assigned to their groups based on their first or second choice focus problem area.

Overall, the number of notes posted to each research group ranged from 8 to 42. Group readership ranged from 41.5% to 48.2%. Within-group readership was highest for mentor notes (range, 28.6% to 44.7% notes read) than for student peer notes (range, 0% to 21.4% notes read). A complete description of the activity within each of the research groups is described in detail below.

**Yelena’s Group**

The focus problem area for Yelena’s group was “Behaviour, Motivation and Learning”. There were 4 students in this research group: Anna, Andrea, Helen and
Gloria. There were a total of 22 notes created in this research group and 78 reads were generated. Of the 22 notes created, 21 were generated by members of this group and 1 was generated by the researcher. Of the 78 reads accumulated, 34 were generated by members from within this group, for group-generated notes. More than half of the reads for notes created by group members were generated by outside readership (53.4%), of which, the majority were generated by other mentors (84.6%). In total, there were 3 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 6 of the reads for notes created by group members (15.4% of the total reads generated from outside the group); 1 was generated from Jelena’s (mentor) notes, 2 were generated from Anna’s notes, and 3 were generated from Andrea’s notes. Table 8.1 summarizes activity for this group.

Table 8.1

*Activity in Yelena’s Online Research Group*

<table>
<thead>
<tr>
<th></th>
<th>Yelena (mentor)</th>
<th>Anna</th>
<th>Andrea</th>
<th>Helen</th>
<th>Gloria</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes Contributed</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Notes Read (within group)</td>
<td>10</td>
<td>14</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td>Mentor Notes Read</td>
<td>NA</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100%)</td>
<td>(20%)</td>
<td>(10%)</td>
<td>(40%)</td>
<td>(43%)</td>
</tr>
<tr>
<td>Group Peer Notes Read</td>
<td>NA</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100%)</td>
<td>(0%)</td>
<td>(0%)</td>
<td>(27%)</td>
<td>(21%)</td>
</tr>
<tr>
<td>Outside Readership Generated by Group Members</td>
<td>18</td>
<td>11</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>39</td>
</tr>
</tbody>
</table>
According to the above table, only 2 of the 4 students contributed notes to their research group. All four students read notes within their research group; all 4 students read notes posted by their mentor, and 2 of the 4 students read notes posted by their peers. In general, the students tended to pay more attention to their mentor’s notes (43% total readership) than to their peers’ notes (21% total readership).

*Emma’s Group*

The focus problem area for Emma’s group was “Beliefs, Attitudes and Learning”. There were originally 4 students in this research group however, one student was allowed to switch research groups since her project was connected to the same outside organization as one of her peers in Elaine’s group. The students that remained in this group were: Ariel, Amanda and Alexis. There were a total of 20 notes created in this research group and 74 reads were generated. Of the 20 notes created, 16 were contributed by members of this group, and 4 were contributed by the researcher. Of the 74 reads accumulated, 20 were generated by members from within this group, for group-generated notes. Approximately two thirds of the reads for notes created by group members were generated by outside readership (69.2%), of which, the majority were generated by other mentors (73.3%). In total, there were 4 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 8 of the reads for notes created by group members (17.8% of the total reads generated from outside the group); 4 were generated from Emma’s (mentor) notes, 1 was generated from Ariel’s notes, 1 was generated from Amanda’s notes, and 2 were generated from Alexis’ notes. Table 8.2 summarizes activity for this group.
Table 8.2  
*Activity in Emma’s Online Research Group*

<table>
<thead>
<tr>
<th></th>
<th>Emma (mentor)</th>
<th>Ariel</th>
<th>Amanda</th>
<th>Alexis</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Notes Contributed</strong></td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td><strong>Notes Read (within group)</strong></td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td><strong>Mentor Notes Read</strong></td>
<td>NA</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(22%)</td>
<td>(33%)</td>
<td>(56%)</td>
<td>(37%)</td>
</tr>
<tr>
<td><strong>Group Peer Notes Read</strong></td>
<td>NA</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0%)</td>
<td>(0%)</td>
<td>(50%)</td>
<td>(7%)</td>
</tr>
<tr>
<td><strong>Outside Readership Generated by Group Members</strong></td>
<td>24</td>
<td>7</td>
<td>3</td>
<td>11</td>
<td>45</td>
</tr>
</tbody>
</table>

According to the above table, all 3 students contributed notes to their research group. All 3 students read notes within their research group; all 3 students read notes posted by their mentor, and 1 of the 3 students read notes posted by their peers. In general, the students tended to pay more attention to their mentor’s notes (37% total readership) than to their peers’ notes (7% total readership).

**Mark’s Group**

The focus problem area for Mark’s group was “Literacy”. There were four students in this research group: Frank, Robin, Elizabeth and Darren. There were a total of 19 notes created in this research group and 112 reads were generated. Of the 19 notes created, 17 were contributed by members of this research group, and 2 were contributed by the researcher. Of the 112 reads accumulated, 23 were generated by members from within this group, for group-generated notes. Nearly three quarters of the reads accumulated for notes created by group members, were generated by outside readership.
of which, 41.4% were generated by other mentors. In total, there were 9 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 38 of the reads for notes created by members in this group (54.3% of the total reads generated from outside the group); 19 were generated from Mark’s (mentor) notes, and 19 were generated from Darren’s notes. Table 8.3 summarizes activity for this group.

Table 8.3

<table>
<thead>
<tr>
<th></th>
<th>Mark (mentor)</th>
<th>Frank</th>
<th>Robin</th>
<th>Elizabeth</th>
<th>Darren</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes Contributed</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Notes Read (within group)</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Mentor Notes Read</td>
<td>NA</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Group Peer Notes Read</td>
<td>NA</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>1</td>
</tr>
<tr>
<td>Outside Readership</td>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>31</td>
<td>70</td>
</tr>
</tbody>
</table>

According to the above table, only 1 of the 4 students contributed notes to their research group. All four students read notes within their research group; all 4 students read notes posted by their mentor, and 1 of the 4 students read notes posted by their peers. In general, the students tended to pay more attention to their mentor’s notes (36% total readership) than to their peers’ notes (6% total readership). It should be noted that since only one student posted notes to this research group, ‘group peer notes read’ could not be calculated for this contributing student since there were no notes available to him.
to read; therefore, his readership was not factored into the overall peer readership percentage in the last column.

**Kim’s (Researcher’s) Group**

The focus problem area for Kim’s group was “Inclusion/Integration”. There were 4 students in this research group: Donna, Erika, Karen and Thelma. There were a total of 36 notes created in this research group and 116 reads were generated. Of the 36 notes created, 35 were contributed by members of the research group, and 1 was contributed by the instructor-participant. Of the 116 reads accumulated, 58 were generated by members from within this group, for group-generated notes. Nearly half of the reads for notes created by this group were generated by outside readership (47.3%), of which, the majority were generated by other mentors (63.5%). In total, there were 10 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 14 of the outside reads for notes created by this group (26.9% of the total reads generated from outside the group); 9 were generated from Kim’s (mentor) notes, 3 were generated from Erika’s notes, 1 was generated from Karen’s notes and 1 was generated from Thelma’s notes. Table 8.4 summarizes activity for this group.

**Table 8.4**

*Activity in Kim’s Online Research Group*

<table>
<thead>
<tr>
<th></th>
<th>Kim (mentor)</th>
<th>Donna</th>
<th>Erika</th>
<th>Karen</th>
<th>Thelma</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes Contributed</td>
<td>19</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>1</td>
<td>35</td>
</tr>
<tr>
<td>Notes Read (within group)</td>
<td>16</td>
<td>2</td>
<td>9</td>
<td>12</td>
<td>19</td>
<td>58</td>
</tr>
<tr>
<td>Mentor</td>
<td>NA</td>
<td>2</td>
<td>8</td>
<td>11</td>
<td>13</td>
<td>34</td>
</tr>
</tbody>
</table>
According to the above table, 3 of the 4 students contributed notes to their research group. All 4 students read notes within their research group; all 4 students read notes posted by their mentor, and 3 of the 4 students read notes posted by their peers. In general, the students tended to pay more attention to their mentor’s notes (45% total readership) than to their peers’ notes (17% total readership).

**Monica’s Group**

The focus problem area for Monica’s group was “Gender Issues”. There were 4 students in this research group: Nammy, Madeline, Marie and the fourth student was the individual who chose not to participate in the study (not reported). There were a total of 8 notes created in this research group and 27 reads were generated. All 8 notes were contributed by members of the research group exclusively. Of the 27 reads accumulated, 7 were generated by members from within this group. The majority of the reads accumulated were generated by outside readership (70.8%), of which, most were generated by other mentors (52.9%). In total, there were 3 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 8 of the reads for notes created by members in this group (47.1% of the total reads generated from outside the group); 7 were generated from Monica’s (mentor)
notes, and 1 was generated from Madeline’s notes. Table 8.5 summarizes activity for this group.

Table 8.5

*Activity in Monica’s Online Research Group*

<table>
<thead>
<tr>
<th></th>
<th>Monica (mentor)</th>
<th>Nammy</th>
<th>Madeline</th>
<th>Marie</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes Contributed</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Notes Read (within group)</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Mentor Notes Read</td>
<td>NA</td>
<td>1 (14%)</td>
<td>4 (57%)</td>
<td>1 (14%)</td>
<td>6 (29%)</td>
</tr>
<tr>
<td>Group Peer Notes Read</td>
<td>NA</td>
<td>0 (0%)</td>
<td>NA</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Outside Readership Generated by Group Members</td>
<td>15</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>17</td>
</tr>
</tbody>
</table>

According to the above table, only 1 of the 3 students contributed notes to their research group. All 3 students read notes within their research group; all 3 students read notes posted by their mentor however, none of the students read notes posted by their peers. Therefore, as with the other research groups, the students tended to pay more attention to their mentor’s notes (29% total readership) than to their peers’ notes (0% total readership). It should be noted that since only one student posted notes to this research group, ‘group peer notes read’ could not be calculated for this contributing student since there were no notes available to her to read; therefore, her readership was not factored into the overall peer readership percentage in the last column.
**Elaine’s Group**

The focus problem area for Elaine’s group was “Health and Well Being”. There were 5 students in this research group: May, Michelle, Phoebe, Rachel and Erin. There were a total of 32 notes created in this research group and 120 reads were generated. Of the 32 notes created, 31 notes were contributed by members of the research group and 1 was contributed by the researcher. Of the 120 reads accumulated, 54 were generated by members from within this group, for group-generated notes. Approximately half of the reads for group-generated notes were generated by outside readership (50.9%), of which, the majority were generated by other mentors (87.5%). In total, there were 4 students that belonged to other (outside) research groups, who read notes within this group. These outside “lurkers” accounted for 3 of the reads for group-generated notes (5.4% of the total reads generated from outside the group); 1 was generated from Elaine’s (mentor) notes, 1 was generated from Michelle’s notes, 1 was generated from Phoebe’s notes.

Table 8.6 summarizes activity for this group.

Table 8.6

*Activity in Elaine’s Online Research Group*

<table>
<thead>
<tr>
<th></th>
<th>Elaine (mentor)</th>
<th>May</th>
<th>Michelle</th>
<th>Phoebe</th>
<th>Rachel</th>
<th>Erin</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes Contributed</td>
<td>17</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Notes Read (within group)</td>
<td>15</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>14</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>Mentor Notes Read</td>
<td>NA</td>
<td>4</td>
<td>4</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Group Peer Notes Read</td>
<td>NA</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>Outside Readership Generated by Group</td>
<td>35</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>56</td>
</tr>
</tbody>
</table>
According to the above table, all 5 students contributed notes to their research group. All 5 students read notes within their research group; all 5 students read notes posted by their mentor, and 4 of the 5 students read notes posted by their peers. In general, the students tended to pay more attention to their mentor’s notes (33% total readership) than to their peers’ notes (21% total readership).

**Summary**

The above data points to two main findings around collaboration, one pertaining to contributions and one pertaining to reading notes. First, two of the online research groups only had one contributing student (student that contributed notes to the group). A lack of contributions from students in these online research groups makes it difficult to encourage collaboration around shared problems since there is little opportunity to see others’ ideas. However, to some degree the mentor may have fulfilled some of the role as a “critical friend” (Costa & Kallick, 1993) to those students who chose to contribute to the ORM. Secondly, while all students paid attention to notes contributed by their mentors, across all six groups there were at least one or two students who did not read any notes posted by their peers. Furthermore, in all six research groups, readership was highest for mentor notes than for peer notes. Arguably, by limiting their attention to their mentor, students were also limiting the number of ideas to which they were exposing themselves. This also makes collaboration around shared problems a challenge, since students appear to be placing an emphasis on the ideas of a relatively small number
people (the mentors); perhaps because they may see more value in the opinions of their mentors over their peers.

**Reflecting Back on the Constraint Analysis**

There are two questions that follow from the two main observations outlined above: 1) ‘Why didn’t all students participate in their online research groups?’ and, 2) ‘Why did students pay more attention to notes contributed by their mentors?’

Aside from the previously mentioned possibility that students’ decisions to participate in the ORM may be tied to their prior experience with carrying out research (e.g., students with less research experience may be more likely to seek help with their research, and therefore, may be more likely to participate in the ORM than students with more research experience), another contributing factor may be time. The MA-T program is set up much like any other teacher education program, in that students are required to take five or six courses in combination with practice teaching. In contrast, graduate study typically places an emphasis on time to engage in independent study and research. Therefore, the intensive programming of the MA-T program around coursework and practicum may be limiting the time available to students for seeking help with their research. The human factors analysis in Phase 2 of the research supports this claim since students admit that there is not a lot of time or opportunity built into the program for them to engage in independent study or carry out their research projects. Furthermore, many students also feel that the research project is not really valued in the program (whereas, they do believe there is a strong emphasis on things like practice teaching).

Another reason for a lack in participation in the research groups and the emphasis of readership on mentor’s notes may be connected to the fact that there is a general
organizational emphasis on the research as being a “project” as opposed to a “thesis”. Although the faculty disagree as to what the students’ research ought to look like, the decision was made in 2005-2006 (the year preceding the design study) that the research project would no longer be a thesis (i.e., a Major Research Project or MRP thesis). The researcher would argue that there are fundamental epistemological differences between project work and the kind of work involved in research, and that the organizational decision to emphasize the students’ research as a project may have had some implications for the ORM. First, in research work, such as involved with carrying out a thesis, there is usually an emphasis placed on sharing one’s ideas with others (i.e., dissemination through research conferences, publications, and/or evaluation by a research committee). By treating the MA-T research as a project, in which the students are only obligated to submit their work to a supervisor - who then makes a decision to ‘pass or fail’ the report - suggests that students may perceive that it is unnecessary to share their work with others, and in fact, that there are no explicit incentives for doing so (from an organizational perspective, such as grades). Second, if the students are not obligated to share their research with others, there may be a perceived de-emphasis on the role of constructive feedback. In this case, the researcher argues that the “project” status of the research emphasizes ‘showing what you know’ instead of a progression of ideas in which the emphasis is on explanatory power around competing ideas. Third, the project status of the research in which students are only accountable to one person for submitting their work (i.e., their supervisor) may reinforce a more traditional, didactic model of teaching in which the instructor tends to hold the balance of power as an authoritative source of knowledge. Therefore, the MA-T students may have been less likely to treat the ideas of
their peers (and even the mentors to some extent, since they were not the ones marking
the research) in the same way that they would treat the ideas of their research supervisors.

Students’ Perceived Impact of the ORM

In this section, the researcher begins with a description of some of the feedback
from students regarding the ORM. Next, the researcher explores some of the human
factors that likely played a mediating role in outcomes of the design study and their
implications for design perturbations in Innovation 1, and modifications in Innovation 2.

Student Feedback

At the end of Innovation 1 of the design study, students were asked to complete a
post-questionnaire which asked them to provide feedback on the process of carrying out
their research in the MA-T program, and their reaction to the ORM as a tool to help
support their research. Out of the 23 student participants, 20 completed the questionnaire
(87% response rate); of the 20 questionnaire respondents, 13 were students who
contributed and read notes in the ORM (contributors), and 7 were students who only read
notes (non-contributors).

At the time of the questionnaire (March 2007), all students had completed their
data collection and had either finished their report that was to be submitted to their
supervisor, or were in the process of completing their report. The majority of students
reported that they had met with their supervisors either monthly, or once or twice during
the year (69.6%) to discuss their research; 1 student admitted that they had never met
with their supervisor. Other students reported that they met with their supervisor weekly,
evry two weeks, or that meetings depended on the time of year and the stage of research.
Despite the variability of meetings with supervisors - never to weekly - all but two students agreed that they received sufficient support from their supervisor. However, 65.0% also said that they felt they could have done a better job on the research project if they had more time to work on it, and 30.4% said they would have been willing to sacrifice one of the four practicum placements in the program in order to spend more time focusing on the research project. On a scale from 1 to 10 (1 being very poor quality, and 10 being very high quality), students, on average, rated the quality of their research project as a 6.

In total, 15 of the 23 student participants in the study contributed and read notes in the ORM, while the remaining 8 students only read notes. Of the contributing students who responded to the post-questionnaire (n=13), 8 agreed that the ORM was useful; 3 others disagreed and 2 responded ‘Not sure’. The five contributing students who did not agree that the ORM was useful were also among the lowest of the contributing students, accounting for only 8 of the 55 student notes posted.

What is most interesting about the responses from students on the post-questionnaire is that both contributing and non-contributing students, as well as contributing students who found the ORM useful and not useful, varied considerably across their ratings in terms of the particular aspects of the ORM that they preferred and didn’t prefer. For example, a high contributing student agreed that she would have been more comfortable discussing her research with her mentor through email (one-to-one communication), and a non-contributing student agreed that they would have preferred a research mentor, but not to be part of a research group. Students’ responses to individual aspects of the mentorship are summarized in Table 9.
Table 9

Student Feedback on the ORM

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Disagree</th>
<th>Not sure / Other</th>
<th>% Agreement (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think the online mentorship is a useful resource</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>40.0%</td>
</tr>
<tr>
<td>I found the advice from my mentor to be helpful</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>50.0%</td>
</tr>
<tr>
<td>I would prefer to work alone on my research project</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td>50.0%</td>
</tr>
<tr>
<td>I would have preferred not to have a research mentor</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>45.0%</td>
</tr>
<tr>
<td>I would have preferred to have a research mentor, but not a research group</td>
<td>9</td>
<td>5</td>
<td>6</td>
<td>45.0%</td>
</tr>
<tr>
<td>I would be more comfortable discussing my research project with my mentor in person</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>60.0%</td>
</tr>
<tr>
<td>I would be more comfortable discussing my research project with my mentor through email</td>
<td>11</td>
<td>5</td>
<td>4</td>
<td>55.0%</td>
</tr>
<tr>
<td>I would be more comfortable working in a private online folder/view for my research project</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>65.0%</td>
</tr>
<tr>
<td>I was less likely to use the online mentorship because I did not feel comfortable with my research mentor</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>20.0%</td>
</tr>
<tr>
<td>I was less likely to use the online mentorship because I was not comfortable with the fact that everyone could see what I posted</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>65.0%</td>
</tr>
<tr>
<td>I was less likely to use the online mentorship because the mentors were not the ones ultimately marking the research</td>
<td>11</td>
<td>9</td>
<td>0</td>
<td>55.0%</td>
</tr>
</tbody>
</table>

In general, feedback seems to suggest that students felt adequately supported by their supervisor throughout the research process, despite the fact that most meetings occurred relatively infrequently (monthly or less). However, many students seemed to
feel they could have done a better job on their research, and would have even been
willing to sacrifice one of their practicum placements - something highly valued in the
program - to have more time to work on their project.

The data also suggests that while most students were comfortable with their
research mentor and their peers, many would have preferred to work alone on the
research. In particular, feedback seems to indicate that privacy was a significant issue for
students as many would have preferred one-on-one, in person and/or private means of
communication. Furthermore, the majority of students admitted that they were less likely
to participate in the ORM because ‘everyone could see what they posted’. This seems to
suggest that the open nature of the ORM was problematic for many students, to varying
degrees since some still participated in the ORM. This issue is explored further in the
section entitled “Emergent Constraints Identified during the Design Study”.

**Human Factors Potentially Influencing Students’ Use of the ORM**

Analysis of the use of the ORM, the impact of the ORM on student collaboration
around their research, and the responses of students to particular aspects of the ORM
suggests that there are a number of constraints that may be influencing the human-
technology relationship in the design study, specifically with respect to the ultimate
affordance of the ORM. Although the ORM was designed to take into account a number
of relevant human factors in the MA-T program, Organizational constraints around time,
status of the student research in the program, level of research support (whether or not
they had regular access to a research supervisor), as well as Psychological constraints
pertaining to research competencies, and technology competencies may have had an
impact on use, collaboration and perceived value of the ORM. In the following sub-
sections, the researcher examines the relationship between student responses to pre- and post-questionnaire information, which specifically pertain to the previously mentioned constraints, in order to suggest which human factors likely had an impact on outcomes related to the ORM. This analysis is not meant to generate firm conclusions about the outcomes in the study, rather it is meant to lend further support to the human factors constraint analysis by helping to direct the researcher’s attention to, and priorities regarding, key design modifications.

**Time as a Factor**

In the post-questionnaire, students were asked to rate their level of agreement with three questions/statements pertaining to time: “There is so much required of students in the MT program that it makes it difficult to dedicate the time and energy necessary to do the research project”, “I felt I could have done a better job on the research project if I had more time to work on it”, and “I would have been willing to sacrifice one of the four practicum placements in the MT program in order to spend more time focusing on the research project”. The student response rate to these questions was 87.0%. A correlation coefficient was then calculated for students’ responses in relation to their level of contribution (number of notes contributed) and readership in the ORM (number of notes read).

There does not appear to be a strong correlation between responses to the statement “There is so much required of students in the MT program that it makes it difficult to dedicate the time and energy necessary to do the research project” with contributions ($r=0.23$) or readership ($r=-0.09$), or for the statement “I would have been willing to sacrifice one of the four practicum placements in the MT program in order to
spend more time focusing on the research project” with contributions ($r = -0.13$) or readership ($r = -0.13$). However, there was a moderate correlation between responses to the statement “I felt I could have done a better job on the research project if I had more time to work on it” with contributions ($r = 0.67$), although not for readership ($r = 0.05$). The negative relationship between willingness to sacrifice a practicum placement to spend more time on the research and activity in the ORM suggests that those who contributed less to the ORM were more likely to agree with the statement. Further, those more likely to agree to feeling they could have done a better job if they had more time to work on the research tended to be students who contributed more to the ORM. A regression analysis on statements relating to time revealed that there were no statistically significant relationships, with the exception of the statement “I felt I could have done a better job on the research project if I had more time to work on it” and contributions ($F = 14.07, p = 0.002$).

Although causal relationships can not be attributed to correlation data, and the strength of the correlations suggests only a weak to moderate relationship between time statements and activity in the ORM, the analysis implies the possibility that time played a role in the outcomes of the ORM differently for students. Some students may have needed more time than others in order to devote attention to participation in the online research groups altogether. Whereas, other students may have enjoyed more time simply for the opportunity to further improve on work they were already doing in the ORM.

**Perturbations during Innovation 1**

The importance of time also became apparent early in Innovation 1 of the design study. Within a couple of weeks into the design, students indicated through informal class
discussion that they were upset by the due dates for the mini research assignments that had been imposed through the Psychology course for the research project. Although these dates had been put in place in response to constraints suggesting that the research was often ‘put off’ by students, the students indicated that the due dates limited their ability to work on the research at their own pace. In the interest of trying to keep the students working on their research throughout the year, but not wanting to limit their sense of agency with respect to time spent on their work, the instructor - in collaboration with the researcher - decided to allow the students to suggest their own schedule for submitting the assignments; each student was allowed to create their own ‘contract’ with the instructor to agree on an individualized timeline.

**Design Implications for Innovation 2**

In light of the data with respect to constraints around time related to the student research projects, the researcher decided that it would be important to further consider time in the design strategies for Innovation 2. In Innovation 2, there were only two due dates assigned for work related to the research in the Psychology course - one at the end of each semester. Students were asked to contribute three short reflections in Knowledge Forum®, which described their progress and growing understanding of their research over the year (in light of principles of learning they were discussing in the Psychology course, but they could also relate other experiences as well). The reflections could be contributed at any time over the semester, and they could take any form that the student deemed relevant to their own needs (e.g., a personal response reflection, or a section of writing for their research project).
**Status of the Student Research as a Factor**

In the post-questionnaire, students were asked to rate their level of agreement with one statement pertaining to the status of the student research in the program: “I think the [MA-T] research project is not given the same weight as a Master’s thesis done in other education programs”. The student response rate to these questions was 87.0%. In general, all students (100% of the respondents) agreed to some degree that the MA-T research project is not given the same weight as other Master’s theses; 3 students responded ‘Somewhat Agree’, 6 students responded ‘Agree’ and 11 students responded ‘Strongly Agree’. A correlation coefficient was then calculated for students’ responses in relation to their level of contribution (number of notes contributed) and readership in the ORM (number of notes read). The status statement resulted in a low level correlation with contributions ($r = 0.30$), and a low negative correlation with readership ($r = -0.05$). These results seem to suggest that there is little evidence of a strong correlation between the status of the student research and activity in the ORM. Further, a regression analysis revealed that the relationship between status of the research project with contributions ($F = 1.61$, $p = 0.22$) and readership ($F = 0.07$, $p = 0.79$) in the ORM was not statistically significant. In other words, it appears that the students’ activity in the ORM was not related to their opinion about the status of the research project. However, the number of students indicating that they agree that the ‘[MA-T] research project is not given the same weight as a Master’s thesis done in other education programs’ is powerful enough to raise concern that status may have an impact on students’ awareness of a distinction between their ‘projects’ and other kinds of research, and also their perceptions of what is valued in the program, and in particular around work related to carrying out research. These
perceptions in turn may affect outcomes related to activity in the ORM to the degree that
students’ awareness and perceptions of the research influence their thinking about sharing
ideas, giving and receiving constructive criticism and balance of power assigned to
authoritative sources of knowledge.

Perturbations during Innovation 1

As mentioned earlier, due dates around the mini research assignments were
changed during Innovation 1 in response to student concerns about managing their time.
However, the instructor - in collaboration with the researcher - decided to keep the final
date of the research conference on the date it was originally scheduled. It was important
to the instructor and the researcher that the research conference - in which students gave a
short presentation of their research - proceed as planned, since its design was in response
to constraints suggesting the MA-T research project is not highly regarded among faculty
in the program. The student research conference provided an opportunity for students to
share (and celebrate) their work with their peers, mentors and faculty. Informal feedback
from students through observations and discussion on the day of the research conference
suggests that students found this to be an enjoyable experience. Many commented that it
was great to have the opportunity to hear what others had been working on, and they
appreciated receiving a booklet of abstracts summarizing the student projects. What was
interesting about this is that despite the fact that many students appreciated hearing about
their peers’ research during the research conference, this had not translated earlier to a
willingness to discuss their research throughout the entire year through the ORM.

Design Implications for Innovation 2
Given the fact that the status of the research is in part related to an Organizational decision to have the students carry out a ‘project’ as opposed to a thesis, it would not have been feasible for the researcher to attempt to influence the perceptions of stakeholders with regard to the research, within the scope of the design study. However, to the extent possible the researcher attempted to design for other, possibly related, Psychological constraints pertaining to sharing ideas, giving and receiving constructive criticism and the role of authoritative sources of knowledge, which are discussed further in a later section in this chapter called “Emergent Constraints Identified during the Design Study”.

**Access to a Research Supervisor as a Factor**

In the pre-questionnaire, students were asked to indicate whether or not they had a research supervisor at the beginning of the design study. Students were given the option to respond ‘Yes’, ‘No’ or ‘Not sure’. The student response rate for this question was 100%. The results indicate that less than half of the students had a research supervisor at the start of the design study (43.5%). A correlation coefficient was then calculated for students’ responses in relation to their level of contribution (number of notes contributed) and readership in the ORM (number of notes read). Responses regarding access to a research supervisor resulted in a low level correlation with contributions (r= -0.19), and a low negative correlation with readership (r= 0.11). A regression analysis revealed that the relationship between access to a research supervisor with contributions ($F= 0.83, p= 0.37$) and readership ($F= 0.31, p= 0.59$) was not statistically significant. However, it is interesting to note that there is a negative correlation between access to a supervisor and activity in the ORM, suggesting that the students who contributed more notes in the
ORM tended to be students who did not already have a research supervisor. Furthermore, students who indicated ‘No’ in response to whether or not they had a supervisor ($n=9$) accounted for more of the student notes contributed in the ORM (40%), than students who indicated ‘Yes’ ($n=10$) to having a research supervisor (25%). This seems to indicate that although there is no strong correlation between access to a research supervisor and activity in the ORM, other possible factors relating to having a supervisor may have an impact (e.g., feeling supported).

In the post-questionnaire, students were asked to rate their level of agreement with the following statement: “I feel I received sufficient support during the research process from my faculty research supervisor”. The student response rate to these questions was 87.0%. Two students responded that they ‘Somewhat Disagree’ with this statement, 7 students responded ‘Somewhat Agree’, 9 students responded that they ‘Agree’ and 2 students responded that they ‘Strongly Agree’. However, responses to this statement do not appear to have a strong correlation to contributions ($r=0.15$) or readership ($r=0.28$) in the ORM. A regression analysis confirmed that the relationship between receiving sufficient support with contributions ($F=0.84, p=0.37$) and readership ($F=2.77, p=0.11$) was not statistically significant.

**Perturbations during Innovation 1**

Although there were no strong correlations between research supervision and activity in the ORM, the higher level of contributions by students who did not have access to a research supervisor at the beginning of the design study may indicate that these students initially sought support through the ORM. The researcher did not make any design changes during Innovation 1 to account for differences in research
supervision, since the researcher believed it was important for students to share ideas and seek feedback from multiple people, interested in similar problems (research interests), whether they had a supervisor or not. Furthermore, access to a supervisor did not guarantee that students had regular access to a group of peers - such as a research group - who shared similar research interests.

**Design Implications for Innovation 2**

Student access to research support in the form of supervision became less of an issue in Innovation 2 of the design study since an Organizational decision was made by faculty in the MA-T program to assign research supervisors to students prior to the beginning of their second year in the program (when the research typically takes place). Therefore, all students in Innovation 2 of the design study had access to a supervisor from the beginning of the academic year.

**Research Competencies as a Factor**

In the pre-questionnaire, students were asked to rate their level skill level pertaining to carrying out research (Novice, Below Average, Average, Above Average, Expert) and their level of agreement with the following statements pertaining to their perceived level of research competencies and attitudes towards the research project: “I feel confident I have the skills to carry out and complete the [MA-T] research project”, and “I would prefer to NOT have to carry out a research project as part of the [MA-T] program”. Students’ response rate to these questions was 100%. Regarding the students’ self ratings with respect to their skill level with carrying out research, the majority of students rated themselves as ‘Average’ (52.2%), ‘Below Average’ (13.0%) or ‘Novice’ (26.1%). There were only two students who rated their research skills as ‘Above
Average’, and no students indicated that they were an ‘Expert’ skill level. Interestingly, one of the ‘Above Average’ students was also one of the more active participants in the ORM, accounting for 9% of the student contributions and 11% of the student readership; the other student did not contribute any notes to the ORM and only read 4 notes. Self-reported skill level pertaining to research does not correlate strongly with contributions \((r = -0.10)\) in the ORM or readership \((r = 0.03)\), although the tendency towards a negative relationship between skill level and contributions seems to suggest that students who contributed more to the ORM were those with less research skills. The majority of students agreed at some level, that they felt ‘confident that they had the skills to carry out and complete the [MA-T] research project’ \((96\%)\), however responses resulted in only a low correlation with contributions \((r = 0.22)\) to the ORM and readership \((r = 0.26)\). A somewhat stronger, although still only moderate, correlation was found between responses to the statement “I would prefer to NOT have to carry out a research project as part of the [MA-T] program” with contributions to the ORM \((r = -0.49)\) and readership \((r = -0.51)\). Interestingly, the negative relationship between not wanting to carry out a research project with activity in the ORM suggests that students who contributed and read less, also tended to be students less interested in doing a research project. A regression analysis on statements related to research competencies revealed that there were no statistically significant relationships with participation in the ORM. However, it should be noted that the regression analysis for the statement “I would prefer to NOT have to carry out a research project as part of the [MA-T] program” approached the significance level for contributions \((F = 6.92, p = 0.016)\) and readership \((F = 7.20, p = 0.014)\).
Perturbations during Innovation 1

The ORM was initially designed to take into account constraints already known about differences among students with regard to prior experience with research. Although the researcher was aware of constraints that suggested students’ attitudes towards the research also differed, this was not explicitly taken into account as part of the design of the ORM. Throughout the design study - through observation and informal discussion with stakeholders - it was apparent that students differed in their level of enthusiasm for the research, and post-questionnaire data confirmed this by indicating that more than a quarter of the students (26.1%) agreed at some level that they ‘would prefer to NOT have to carry out a research project’. However, it would not have been within the scope of this study to orchestrate an Organizational change that would allow some students an alternative to carrying out the research project, nor would it have been practical to try and account for all of the personal reasons why students would have preferred not to do a research project. Instead, the mentors were reminded to provide positive feedback in all of their exchanges with students through the ORM, and students were encouraged to select topics that they felt were important to practice, but also held personal interest. Furthermore, the researcher hoped that the small research group design in the ORM, in which members shared a common focus problem area, would help sustain interest in the research through the collaborative process.

Design Implications for Innovation 2

In Innovation 2 of the design study, the researcher continued to support students’ research through the Knowledge Forum®, and through access to a mentor. However, in Innovation 2 a decision was made to have only one mentor - the researcher - who also
saw students face-to-face on a regular basis. This relates to emergent constraints identified during Innovation 1 of the design study, and is discussed later in this chapter. As with Innovation 1, the researcher felt it was outside the scope of the design study to address Organizational constraints pertaining to the requirement that all students complete a research project as part of their program despite the fact that not all students were interested in carrying out research.

**Technology Competencies as a Factor**

In the pre-questionnaire, students were asked to report how often they participate in online discussions (e.g., chat rooms, discussion forums), and also to rate their level of agreement with the following three statements: “I feel confident in my ability to use computers”, “I feel confident in my ability to participate in online discussions”, and “I do not feel comfortable participating in online discussions”. Students’ responses to how often they participate in online discussions was split down the middle with 47.8% indicating seldom (Extremely Seldom, Seldom, Somewhat Seldom) or never, and 52.2% indicating often (Somewhat Often, Often and Extremely Often). There was a low to moderate correlation between frequency of use of (outside) online discussion, and contributions ($r= -0.35$) and readership ($r= -0.13$) in the ORM. Interestingly, the negative relationship seems to suggest that students who contributed and read less in the ORM were also students who reported higher frequency of participation in online discussion (outside the ORM). A similar negative relationship was found between students’ self reported confidence in their ability to participate in online discussion and contributions to the ORM ($r= -0.31$). Student reports of frequency of participation in online discussion and self reported confidence in their ability to participate in online discussion was
positively correlated ($r = 0.66$). Although the majority of students report some level of agreement with the statement that they are confident in their ability to use computers (87.0%), it was not strongly correlated with contributions to the ORM ($r = 0.18$) or readership ($r = -0.05$). Furthermore, students’ responses to the statement “I do not feel comfortable participating in online discussions” does not appear to be strongly correlated with contributions to the ORM ($r = 0.02$) or readership ($r = -0.10$), although it should be noted that 7 students agreed at some level that they were not comfortable participating in online discussions (30.4%). This may in part be due to feelings of being uncomfortable with the public nature of the ORM (open design), mentioned earlier (see section on Student Feedback), and which is discussed in the next major section on “Emergent Constraints Identified during the Design Study”. A regression analysis on statements relating to technology competencies revealed no statistically significant relationships with participation in the ORM.

**Perturbations in Innovation 1**

Although the majority of students felt confident in their ability to participate in online discussions (91.3%), and more than half of the students reported that they often participated in online discussions (outside of the ORM), the data seems to suggest that these factors are negatively correlated with contributions to the ORM and readership in the ORM. Observations of students in the MA-T program during Innovation 1 confirm that many of them participated in online discussion outside the ORM, such as through personal email accounts, discussion forums such as Facebook, and online chat through tools like MSN. What this seems to indicate is that students who are active users of online discussion (outside the ORM) may have been less likely to participate in the
ORM. It is possible that students who are familiar with, and frequently use online discussion forums, may be less inclined to use them as a tool for learning, perhaps because they do not want to participate in multiple online discussions. Although the researcher made note of students’ outside participation in other online discussion, the researcher did not specifically make any design decisions during Innovation 1 to take this factor into account. The researcher simply took an interest in students’ activity in other online discussion, and used the opportunity to learn more about how students were using them. The researcher’s observations and informal discussion with students who used these outside online discussion tools seemed to suggest that they were mainly places to engage in social conversations; there did not appear to be any conversation that pertained directly to the students’ research projects based on what could be observed.

**Design Implications for Innovation 2**

While it is important to note that many students in the MA-T program engage in online discussion outside the ORM, and that this appears to be negatively correlated with activity in the ORM, the researcher did not want to restrict students’ use of other online tools. Firstly, it would not have been feasible to monitor students’ use of other online tools throughout the design study. Secondly, it is not clear from correlation data alone that students’ use of other online tools is detrimental to their participation in the ORM. Third, the researcher believes that there is the potential to learn something from the way that students are using these outside online tools, and how they could potentially support students’ work in the MA-T program. Therefore, the researcher decided to make note of students’ use of other online tools as information that may provide further insight into the
constraint analysis, however, there were no direct implications on design for the purpose of the design study.

**Mentor Feedback on the ORM**

Once Innovation 1 of the design study had been completed, the researcher asked the mentors to provide feedback on the ORM in the form of a post-questionnaire (response rate = 100%) (note, there are five respondents since the researcher, who was also a mentor, did not fill out the questionnaire). Four of the 5 mentors agreed that they enjoyed being an online mentor; 1 mentor responded ‘Not sure’. The mentor that responded ‘Not sure’ was Monica, whose research group consisted entirely of non-contributing students. All except for Monica also agreed with the statement “I think the students benefited from having access to the online research forum”. However, all 5 of the mentors agreed that they were often left wondering whether their advice was of any use to their students, and that they expected students to participate in the online mentorship more often than they did. All 5 mentors agreed that they thought some of the students would have preferred to discuss their research in private, and 4 of the 5 mentors admitted that they had at least one student from their research group that contacted them through private email instead of through the ORM. Two of the mentors also agreed that they would have preferred to advise their students in private.

The mentors were also asked to provide responses to open-ended questions about their impressions of the student research, and their experiences with the ORM. The following are some of their written responses:

**Yelena:**
[How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?] Many were ambitious, and sometimes a little "all-over-the-place" - they needed to be more focused. Most of the topics seemed relevant, although in general they were very practice-centered and at the time I saw the work, the projects were not necessarily all grounded in the research in the field. I had the feeling that some were simply about to re-investigate what had been done many times before...and they could look up the answers in a book.

Mark:
[How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?] The students all had relatively clear ideas, but were too general and/or ambitious in nature. They needed an orientation to academic scope and narrowing their focus to meaningful work. I only got to see one student's extended piece and his passion was clear and I was able to provide more insight and help, but the others lacked that focus, that specificity.

[How do you think the students may have benefited from the online research forum?] It's really hard to tell. If I had to guess, I'd default to a cliche: I think they probably got out of it what they put into it. The students that I communicated with more often seemed to develop their ideas with more focus and articulation. Unfortunately, a couple students really didn't communicate much.

[How could your experience participating as a mentor in the online research forum have been better?] Well, truth be told, I felt like I didn't do much. My participation was limited to one semester and I didn't connect with any of the students, I felt. Perhaps that was because I was used to teaching high school students in a conventional, face-to-face instructional setting. There were many, many times where I took this as a personal failure and wasn't sure what more I could do because I was limited to the forum threads. I just don't feel like I helped any of the students, except for one, beyond a sort of introductory response-level. I don't know if it was a result of my own doing, the limitations of the software, the reluctance of the students or some combination of the above. I guess what I would've hoped for more was a more consistent back and forth dialog with more than just a couple of the students.

Elaine:
[How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?] My impression in general was that they had little
opportunity to plan and execute a real research project. They could only collect data in their practicum placements and therefore they were limited in terms of what they could do. Also, I think that they didn't have enough time or support to really pursue research so it was squeezed in around other priorities.

Monica:

[How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?] From what I saw, the research questions were too general.

[Why do you think some students chose not to participate in the online research forum?] It was public, it was time-consuming, and they didn't know their mentor.

Emma:

[How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?] They were more like term papers both in scope and quality.

[How do you think the online research forum could have been better designed to support the students' research?] Provision for private communication and using a pool of mentors rather than splitting in groups.

[Why do you think some students chose not to participate in the online research forum?] Not wanting to share their interim ideas with others. Feeling insecure. Not trusting online mentors.

In general, all except Monica felt that the online research mentorship was a good personal learning experience. All of the mentors disagreed with the statement “Participating as a research mentor took up too much of my time”. Furthermore, all 5 also agreed with the statement that “Doctoral students planning to have an academic career, should have the opportunity to gain research advising experience as part of their program”, although 3 of the 5 admitted that they had not had such opportunities outside of their experience with the ORM.
When asked if they would participate as an online research mentor again, Mark, Yelena and Elaine agreed, Emma responded ‘Not sure’, and Monica responded ‘Somewhat Disagree’. However, all 5 mentors agreed that they would participate as a research mentor again, even if it were face-to-face and not online. This suggests that a couple of the mentors may have found the online environment to be somewhat problematic rather than the act of being a mentor itself.

**Emergent Constraints Identified During the Design Study**

Through the process of Innovation 1 of the design study, two new constraints were identified (constraints that were not revealed through the original CWA). These two constraints are explained below. The researcher then elaborates on the design implications of these emergent constraints for Innovation 2 of the design study.

**Feelings of Privacy around the Research Projects**

The first of the two emergent constraints pertains to feelings of privacy around ideas, and in particular around the student research projects. As mentioned in the section on ‘Students’ Perceived Impact of the ORM’, many students expressed that they would have been more comfortable discussing their research in private, or through one-on-one communication (e.g., email). Sixty-five percent of the students that responded to the post-questionnaire indicated that they were less likely to use the ORM because they were not comfortable with the fact that everyone could see what they posted. Furthermore, 45.0% indicated that they were ‘uncomfortable with the public nature of the online discussion forum’. However, what is interesting is that 90.0% of the students indicated that they ‘felt comfortable sharing their ideas in the online discussion forum’ (Knowledge Forum®)
that was part of their weekly class discussion in the Psychology course. This seems to suggest that there may be a perceived difference between sharing ideas related to coursework and sharing ideas related to the research projects for some students.

When asked about which aspects of their research they felt comfortable sharing, 40.0% of the students admitted that they are ‘comfortable sharing their research with others once it has been completed, but not while it is still in progress’, and another 15.0% admitted that they were ‘not comfortable sharing their research, even once it has been completed’. One student indicated that they were only comfortable sharing their research ‘in person, in small groups or as a class’, and another qualified her response by saying she was only comfortable sharing some aspects of her research. In total, 65.0% of the students were at least partially uncomfortable with sharing their research. This is in stark contrast to the 90.0% that said they were comfortable sharing their ideas in the weekly online discussion forum for their Psychology course.

During the design study, the researcher was also made aware of the fact that one of the students had contacted their mentor through email in order to discuss their research. The mentor approached the researcher to discuss how to handle the situation. Not fully appreciating the extent or pervasiveness of this concern (the desire to communicate in private through email) at the time, the researcher suggested that the mentor offer the student a private view rather than communicating via email. There were three reasons for this decision: 1) the researcher wanted to minimize the need for the mentor to check multiple sources for student notes, 2) the researcher wanted to encourage the student to take part in discussion around the focus research problem (common research interest for the online group) with their peers, as much as possible. It was
thought that by removing the student-mentor conversation from the ORM altogether that this would discourage any kind of convergence around work related to the focus problem area, and 3) it would be difficult to monitor and assess the degree of the affordance of the ORM in the context of the MA-T program if students began using other online tools for the purpose of supporting work related to their research. As with the previous student mentioned, this student did not post any notes to their private view in the ORM. At the end of the study, mentor feedback suggested that there were at least three other students who contacted their mentors through private email.

While it may be the case that it is the public nature of Knowledge Forum® that discouraged some students from participating in the ORM, this doesn’t explain why the majority of students were comfortable discussing in the online environment for their Psychology course. What seems more plausible is that there is something about the ORM and work related to the research projects in particular, that makes the open structure of the discussion forum problematic. For example, it is possible that some students were not comfortable discussing their research since their data was collected primarily in their practicum school sites - in which case, critical evaluation of practice may be perceived as a public defaming of their associate teachers (something that is considered contrary to ethical practice among teaching professionals in Ontario). Another constraint that may be affecting sharing research in the ORM is the fact that at the Organizational level the research is considered a ‘project’ and not a thesis, and so students are not required to share their research with anyone except their research supervisor; furthermore, there are no explicit incentives for sharing their work beyond their research supervisor (e.g., grades). It is also possible that posting the research in the ORM became a source of
competition among students, if some were not as far along in the research process as others. This may be especially true since the research is set up as a ‘project’, which the researcher would argue, tends to encourage individual learning (i.e., showing what you know) over collective understanding around a problem (i.e., explanatory power around competing ideas). Early in the design study, one student mentioned that her peers had expressed concern (to her) that she had posted a draft of her literature review in the ORM, and this was because they had either not started their literature review, or were still working on it. In an interview with this student she said:

The one thing that, the mentoring thing, is I posted my lit review, you saw it cause you emailed me. But people in the class keep coming up to me and being like ‘Oh I saw you posted your lit review.’ And I was like ‘Yeah.’ And they’re like / I’m not saying it’s good quality, like it’s going to change a lot. But I feel like it’s making other people feel like, well not everyone, but like some people are coming up to me and like ‘I haven’t even started yet.’ Like, it’s making other people feel like pressured, and being all worked up about it. And so I was like ‘I don’t want to make other people feel like that.’ And also that like, they’re like “Oh she’s done it” and like, I don’t know “Typical [Andrea]!” like kind of thing.

After this confrontation with her peers, this student posted only two more notes to the ORM.

While the exact reason for some students’ lack of comfort in sharing their research - and specifically in the context of the ORM - is not entirely clear, what seems evident is that feelings of privacy around the research is a concern, and that this has likely had an impact on students’ activity in the ORM.

** Outsiders/Strangers  

The second constraint that was revealed through the design study was with regard to the ‘outsider’ or ‘stranger’ status of the online mentors, throughout the year. At the end
of the design study, students admitted that they felt like they didn’t really know the mentors despite being introduced to them in person at beginning of the year, and despite the fact that the mentors had posted an introductory note in the ORM describing some personal and professional information about themselves. Furthermore, despite the fact that many students carried on discussions with their mentors over the year in the ORM, many indicated on the post-questionnaire that they were unsure about various facts about their mentor. For example, when asked to rate their level of agreement with the statement “I consider my mentor to be knowledgeable about teaching”, 90.0% responded ‘Not sure’ despite the fact that students had been informed that three of the mentors were currently, or had been, practicing classroom teachers, and despite the fact that all of the mentors were graduate students in education. Also, half of the students responded ‘Not sure’ when asked to rate their level of agreement with the statement “I consider my mentor to be knowledgeable about the process of conducting research”, despite the fact that the mentors were introduced as doctoral level graduate students.

Another example of the mentors being seen as ‘others’, or an outsider, by the students is with regard to the perceived value of the mentors’ feedback through the ORM. More than half of the students (55.0%) commented that they were less likely to use the ORM because the mentors were not the ones ultimately marking the research, and some students commented in open-ended responses that they found it unhelpful when their mentor offered advice that contradicted their research supervisor. For example, one student commented:

It was a bit confusing for me when my research supervisor approved my topic whereas my online research mentor believed I should narrow it down. This simply put me in an awkward position.
Instead of seeing the mentors’ advice as an opportunity to further improve their ideas around the research, some students found the additional feedback to be “confusing”. One student commented that “by asking [MA-T] faculty I can be assured that I am getting accurate information since they are intimately aware of the [program] requirements”.

It is possible that the online environment, in combination with a lack of face-to-face contact with the mentors created a feeling of being disconnected from them. What also seems likely is that the ‘project’ status of the research, in which students are only obligated to submit their work to their supervisor, may have made it more likely that advice from others, such as the mentors, would be seen as less accurate, or less valuable than the advice from their supervisors.

**Design Implications of the Emergent Constraints**

In Innovation 2 of the design study, the researcher decided to address the same 24 constraints that had been addressed in Innovation 1, with some design modifications based on outcomes of the design study, in addition to feedback from students and mentors. The researcher also decided to address the two emergent constraints that were identified as these were considered to be directly relevant to the design study, and design modifications to address these constraints would be relatively easy to implement.

In particular, the researcher decided to address the ‘research privacy’ constraint by allowing students more options to create private and semi-private views in the online mentorship. The researcher believed this could be an effective way to scaffold collaboration, while respecting the fact that some work with ideas needed to happen in private. Furthermore, in order to address the ‘outsider/stranger’ constraint, the researcher
decided to only have one mentor in the online mentorship - the researcher - who the students would see face-to-face on a regular basis.

**Summary**

In this Chapter, the researcher outlined the results of Innovation 1 of the design study phase of the research (Phase 3). Results suggest that discussion in the ORM mainly centered on the first four steps of Creswell’s (2008) Steps in the Research Process. Furthermore, the data indicates that some students in the MA-T program found the ORM to be a useful resource in supporting their research however, not all students participated to the same extent. An examination of efforts to support collaboration around the research also show that not all students contributed notes to their online research group, and that students tended to pay more attention to mentor notes than to notes of their peers; some students read notes posted by the mentors exclusively. Also, none of the discussion in the ORM occurred between students; discussion only occurred between mentors and students. Student and mentor feedback at the end of the design study suggests that many students would have preferred to work in private or one-on-one with their mentors, and that some students felt the advice given by the mentors was contradictory to their research supervisor, and was therefore unhelpful and made them feel confused and/or awkward.

Analysis of the outcomes from Innovation 1, in light of the constraints identified in Phase 2 of the research, suggest that other factors - not specifically addressed as part of the design study - played a mediating role over activity in the ORM. Some of these factors are at the Organizational level, and are therefore not easily addressed within the scope of the design study. However, where feasible, the researcher has used the outcomes
of the design study to re-design the ORM in order to better address the same constraints examined in Innovation 1. Furthermore, the researcher also considers the two new emergent constraints as design criteria for Innovation 2.

The following chapter will begin by summarizing the new design implications for each of the previously-examined constraints based on outcomes and feedback from Innovation 1, as well as the two new emergent constraints revealed during the design study.
CHAPTER SIX: RESULTS OF INNOVATION 2

The preceding chapter described the results of Innovation 1 of the design study that was implemented in the context of a two year graduate level teacher education program (MA-T). Using the human factors constraint analysis, developed from data collected during Phase 2 of the research (Chapter 4), an open online research support forum was developed to support MA-T students in carrying out their research projects as part of their initial teacher training. In Innovation 1, this open online research support forum took the form of an online research mentorship (ORM), involving 6 doctoral student mentors. In Innovation 2 of the design study, the researcher re-designed the ORM based on outcomes from Innovation 1, and in light of the human factors identified in Phase 2. The second innovation in the design study took the form of a Student Online Research Support Centre (SORSC). The design of SORSC took into account the 24 initial constraints addressed in Innovation 1, with the addition of two new emergent constraints identified during the design study. In this chapter, the researcher outlines the results of Innovation 2 of the design study (Phase 3 of the research), carried out during the 2007-2008 academic year.

(Re-)Design Implications of the Human Factors Constraints

The following section describes the re-design strategies and new design implications addressed in Innovation 2. Some of the design strategies remained consistent between Innovation 1 and Innovation 2. Appendix S summarizes the constraints considered in the (re-)design of the online mentorship, their implications and the specific design strategies taken by the researcher.
Overall (Re-)Design of the Online Mentorship

There were some aspects of the online mentorship that remained consistent between Innovation 1 and Innovation 2, and some design strategies that were new in Innovation 2. One of the consistent features of the online mentorship across both years of the design study was the use of Knowledge Forum®. As mentioned elsewhere, Knowledge Forum® has a flexible design, with many functions, that would allow the researcher to tailor the environment to accommodate different constraint priorities. Other consistencies between both years of the design study were that the innovations involved making a connection between pedagogical (course-based) strategies through the Psychology course with program objectives more broadly (through the design of the open online research support forum), and that the researcher also participated as a mentor.

Some of the features of the design that changed between Innovation 1 and Innovation 2 included: the use of private views for reflecting on the research projects as part of their expectations for the Psychology course, the reduction in the number of mentors from 6 to 1 (a mentor that they see regularly, face-to-face), elimination of the email notifications, a scaffolded design to encourage collaboration between students around the research, and a change in the name of the online mentorship from the “Online Research Mentorship” (ORM) to the “Student Online Research Support Centre” (SORSC). The change in name was meant to reflect the individualized design of the online research support, since students could create their own groups - both public and private - according to their own needs. Also, by de-emphasizing the word ‘mentor’ the researcher believed this would represent a shift in thinking about the online research support from being simply ‘advice-giving’ from an authoritative source, to work with
their own ideas under the guidance of an experienced researcher. Through SORSC students had access to general research-related information from the previous year’s ORM, a copy of students’ research abstracts from the previous year (2006-2007), public and/or private work folders, and a “Peer Review” view in which students could contribute work related to their research to get feedback from the entire class. Through SORSC’s scaffolded design the researcher hoped that this would allow for students to gradually work their way towards openly sharing their work by giving them the opportunity to create private individual folders, private group folders, open individual folders and/or open group folders - and when ready, they could contribute to the Peer Review, which was open to all their cohort peers. Students were encouraged to select an option that they felt most comfortable with, having the ultimate goal of eventually openly sharing their research through the Peer Review, and finally the research conference at the end of the year.

The researcher posted two notes at the beginning of the year, to suggest reasons for, and ways of using SORSC. The following is a note that the researcher posted entitled “Why use the online research support centre?”:

Here are a few good reasons to consider making use of the online research support centre:

1. Forgot your USB key? The online research support centre is a place where you can keep your research files and access them from anywhere with an Internet connection.

2. An easy way to share resources with your research group members, and/or work on a document together.

3. Save your space! Uploading too many files to your [names university email system] email will eventually fill up your space quota, making it difficult to send and receive messages.
4. A way to get assistance and feedback when your need it. The online research support centre is always open! Post a note anytime and 'ye shall be heard'! :-) 

5. Power in numbers. Take advantage of The Peer Review (The Peer Review) folder and discover how 41 heads are better than one! 

6. See what others have done. Access the research abstracts from last year's MT students (Abstracts from 2006-7). 

The following is a note posted by the researcher on using the scaffolded design for sharing research in SORSC entitled, “Should I go public or private?”:

The Student Online Research Support Centre was designed to be as flexible as possible so that you get the kind of support best for you. 

You may be the kind of person that likes to work on things by yourself for a while, and then share when you're ready. 

You may be the kind of person that loves to talk and share your ideas, even when you don't have it all worked out yet. 

And maybe you're somewhere in between. 

You can request individual private folders, individual public folders, group private folders, and group public folders. Also, feel free to have a private and a public folder. 

And when you're ready...

Post your ideas, drafts and questions to The Peer Review (The Peer Review). When it comes to research - sharing, discussing, and improving ideas are critical to making progress. Dare to share! 

Although all of the constraints addressed in Innovation 1 were re-addressed in Innovation 2, many of the re-design features of the online mentorship were guided by feedback from the first year of the design study, and implications from the emergent constraints that were revealed. Generally, the researcher wanted to know whether the re-
design strategy would be able to overcome some of the limitations in the previous design, specifically with respect to encouraging collaboration around the student research projects.

**Research Questions Guiding Innovation 2**

The same questions that guided analysis of Innovation 1, also guide analysis of Innovation 2, with the exception of feedback from the mentors since there was only one mentor (the researcher) in the second year of the design study. The main research question addressed in this chapter is: What is the impact of an open online research support forum (i.e., the Student Online Research Support Centre), designed using a Human-Tech framework for technology integration, on students’ experiences in carrying out research as part of their initial teacher preparation in the context of a two-year graduate level teacher education program? There are three guiding questions that the researcher uses to answer this research question:

1. How did students ultimately use the Student Online Research Support Centre?
2. To what extent did the Student Online Research Support Centre scaffold students’ ability to collaborate with others around their research?
3. What was the perceived impact of the Student Online Research Support Centre for the MA-T students?

**Use of the Student Online Research Support Centre (SORSC)**

In general, students’ use of SORSC was limited almost entirely to the private reflection journals as part of the Psychology course (which is part of the design, although not directly part of the SORSC). Initially, some students had raised a concern - through informal class discussion - that some people may not wish to discuss their research in the
reflection journals, since they already had their supervisors with whom they could discuss their research. Some students asked whether they could write about their understanding of topics related to the course, or things that happened during practicum in their journal, instead of their research. Others, were concerned that they are already asked to do too many reflections in the MA-T program and that the instructor was asking too much of them to submit four 250-word reflections per semester; so, they requested that the number of reflections be reduced or that they be given an alternative assignment that focused solely on Psychology. Given the number of issues raised by the students, the researcher suggested that the instructor take some time to think about the feedback, and also give students time to think about a solution to the concerns raised; they (including the students) would decide on a solution in the next class. Taking the students concerns into consideration and in light of what was known about the MA-T program through the constraint analysis from Phase 2 (Chapter 4), the instructor - in consultation with the researcher - decided she would allow students to write about any topic of their choice in their reflection journals, and that they would only need to submit three instead of four reflections per semester. She also gave them the option to submit a reflection paper, as an alternative assignment to the reflection journals. The students decided that this was an agreeable solution, and no other solutions were offered by students themselves. In the end, 35 of the 38 student participants decided to maintain the reflection journals for the Psychology assignment; most of these focused on their work related to the research projects.
Content Analysis of Research Reflections

As with the notes contributed by students in Innovation 1 as part of the ORM, the notes that discussed the student research projects in the online reflection journals tended to focus on the first four Steps in Conducting Research (SCR) by Creswell (2008): identifying a research problem, reviewing the literature, specifying a purpose for the research (including forming specific research questions), and collecting data. However, many of the students’ notes also discussed their ideas and problems encountered around analysing their data, and writing up their findings; something that was seen much less in the ORM during the first year of the design study. Furthermore, the content of the students’ notes also differed from notes posted in the ORM in that they tended to be much longer and full of detailed narratives about the research process from their perspective as a student in the MA-T program. Many of the student notes suggested that there was a strong emotional connection between the students and what they were writing. Students tended to use words like ‘overwhelmed’, ‘staying motivated’, having to put their research ‘on the back burner’ to meet more immediate demands in the program, ‘feeling confused’ and ‘disappointed’, and ‘lack of support’. However, many students also expressed how much they enjoyed carrying out their research, despite the obstacles they encountered and the pressures they felt.

Appendix T provides some excerpts from students’ reflections about their research in the online journals. The researcher has chosen to share small sections of journals by students who elected to copy their private folders into the SORSC forum (see next major section). The researcher has not reported contents of journal notes from the Psychology course forum, since the understanding was that these folders contained
private conversations between the instructor and the students, and many students had divulged very personal information. Therefore, the researcher did not feel it was appropriate to document contents from these notes. However, notes from those who chose to share their private folders with the researcher in the SORSC forum are a good representation of the kinds of reflections students typically had in their private views. Names have been changed to protect the identities of the students.

**Results from the Analytic Toolkit**

In total, 35 of the 38 participants in the second year of the design study elected to maintain the private online reflection journals for the Psychology course. There were a total of 428 notes posted in participants’ journals, of which, approximately half were created by students and half were response notes from the instructor and/or researcher-mentor. Readership in the journal views was exclusive to the instructor, the researcher-mentor and the individual student since these journals were private; therefore, students did not have access to their peers’ notes as in the first year of the design study. By the end of the study, there were no open or group notes posted by students in the SORSC.

**Results from Questionnaire Feedback**

As in year one of the design study, in addition to conducting a qualitative analysis of the online notes to get a sense of how the students were using the online journals, the researcher also received feedback from the students - as part of the questionnaire distributed at the end of the year - about how they tended to use the online reflection journals. Twenty-four of the 38 student participants (63.2% response rate) responded to a question asking: “How did the online reflection journals help you with the overall process of your research?” Twenty-two of the 24 respondents were among the students who
elected to do the online reflection journals for the Psychology course. Of these 22 students, among the most frequent responses to the above question were: ‘Emotional support/encouragement to complete my research’ (31.8%), ‘Brainstorming ideas’ (18.2%) and ‘Helping with my data analysis’ (13.6%). The relatively high response of ‘Emotional support/encouragement to complete my research’ coincides with the researcher’s interpretation that the students’ notes tended to be highly connected to their feelings and personal experiences around the process of carrying out the research in the MA-T program.

**Reflecting Back on the Constraint Analysis**

In looking back at the constraint analysis (Chapter 4), there are a number of factors that may have played a role in how students ultimately ended up using the SORSC. In general, although the students ended up using the online reflection journals as part of the Psychology course - many for the purpose of reflecting on their research - the students did not really use SORSC in the way that it was fully intended; most students were not ultimately involved with SORSC. There were only a small number ($n=11$) who participated in SORSC however, these students only used their existing private views in which to discuss their research by copying them from the Psychology course view into the SORSC. The students did not elect to create group views, or open (public) views in which they could discuss their research with their peers and/or the mentor. Furthermore, students never posted any notes to the ‘Peer Review’ - in which there was complete open access to notes by all students - for discussion or feedback.

What seems evident from both the content of students’ research reflections and the constraint analysis (Chapter 4) is that MA-T students feel the pressure of time to carry
out their research projects. Many of the students mention in their research reflections that they did not have enough time to do their research in combination with other expectations in the program. This likely had an impact on the amount of time students had available, and were willing to spend, seeking out support and feedback through the SORSC. Furthermore, many students also mention that they felt they could have done a better job on their research projects, had they had more time to focus on it.

As was also evident through the CWA interviews with students, and questionnaire feedback in the first year of the design study, students seemed to think that faculty were not always clear and consistent about their expectations for the research projects, and that their research projects were not given a lot of priority among faculty in the MA-T program. In one research reflection, a participant commented that many students felt they were misinformed at the beginning of the program about the type of research that is carried out in the MA-T program (i.e., that it is not a thesis) and in another student reflection it was suggested that there were faculty in the program who admitted that they did not see the value in the type of research that students carry out, beyond their own personal learning experiences; these student comments are also confirmed by the original human factors constraint analysis (Chapter 4). These findings, together with the fact that at the Organizational level the research is defined as a “project” and not a thesis, likely had implications for student activity in SORSC. As in the first year of the design study, the fact that the students’ research is a ‘project’, which they are only obligated to share with their supervisor, combined with the fact that there is a general perception among students that the research is not given a lot of priority within the program (in comparison to other Master’s level research), might make it less likely that students will seek out
feedback from others, and in particular, they may perceive that there are no explicit incentives for doing so (e.g., increased grades, increased respectability for the research).

**Impact of SORSC on Collaboration around the Student Research**

In December, in light of the fact that the researcher had not been able to follow up with all of the students regarding consent to participate in the study due to numerous unforeseen postponements during the Psychology course, the researcher was invited by the program coordinator to come to one of the other MA-T classes to discuss SORSC with students again, and address any questions or concerns that may be outstanding around participation in the design study. This course was a good opportunity in which to talk to the students since the instructor (the program coordinator) only saw half the students at a time, allowing the researcher to have a conversation with a smaller number of the students. The researcher also thought that this would show that there was more wide-spread support from faculty members for the use of SORSC as a research support tool (i.e., beyond the instructor-participant, the Psychology instructor). During the conversation with students, many raised concern about having little time to work on their research, even if they had wanted additional feedback. So, the researcher suggested that if the students would like to receive feedback from the researcher-mentor on their research, they could consider copying their private reflection journal into SORSC. The researcher explained that the reflection journals in the Psychology course were considered a private exchange between the students and the instructor, and therefore the researcher would not comment on them unless the students specifically requested it. However, copying their private folder into SORSC could signal to the researcher-mentor that students wanted additional feedback, and this would not require them to do any additional work (other
than copying the existing folder, which is a feature of Knowledge Forum® involving selecting a command from a drop-down menu). The researcher also suggested that the students could contact her by email if they wanted her to copy their folder into SORSC, in the event that they were confused about how to copy the view. The researcher hoped that by encouraging students to seek additional feedback from the researcher-mentor through SORSC, they might eventually share their research with others, specifically their peers who might be working on similar problems.

There were 11 students who copied their private research journals into the SORSC. The researcher read through the notes posted by students, as well as the feedback given by the instructor, and then added her own comments and suggestions. Subsequently, there were no new notes posted from students in response to the mentor’s feedback. Furthermore, many students had not commented on the instructor’s initial feedback given earlier in the year.

By the end of the design study, none of the students had elected to create group folders or open folders in SORSC to discuss their research. Furthermore, none of the students posted their work to the open ‘Peer Review’ folder. As in the previous year, students shared their work at the research conference held in March (a few weeks before the end of the academic year - also the end of the program for second year students). Students commented that it was nice to hear about what others had been working on, and even that the act of sharing their research with others was beneficial in helping them complete their final write up, since it helped them to be clear and concise about their ideas. However, as with the previous year, this appreciation for sharing their research had
not translated earlier on into supporting discussion and collaboration around their research.

Lastly, there were only 14 students that read the online note containing the abstracts from the students’ research from the previous year (2006-2007). This may have been partially due to the fact that students, in general, did not participate in SORSC which is where the note was posted. However, this would not explain why 7 of the 11 students who copied their private view into SORSC did not open the note containing the abstracts. It is also possible that students were not aware that the abstracts were there, although this is unlikely since the students had been informed by both the researcher and the instructor of the fact that the abstracts could be found in SORSC, and the note appeared in the main page of the SORSC. Furthermore, it would not explain why some students that read the note ‘Why use the online research support centre?’ which was posted by the researcher and included a direct link to the abstracts (see previous description earlier in this chapter), did not ultimately read the note containing the abstracts. Instead, these findings may indicate the degree to which students saw the research of their predecessors as relevant to the work they were currently doing.

**Reflecting Back on the Constraint Analysis**

As mentioned in the previous chapter, an Organizational decision was made in 2005-2006 (the year preceding Innovation 1 of the design study) that the research project would no longer be a thesis (i.e., a Major Research Project or MRP thesis). The researcher argues that there are fundamental epistemological differences between project work and the kind of work involved in research, and that the Organizational decision to emphasize the students’ research as a project may have had some implications for student
collaboration around their research in SORSC. First, in research work, such as involved with carrying out a thesis, there is usually an emphasis placed on sharing one’s ideas with others (i.e., dissemination through research conferences, publications, and/or evaluation by a research committee). By treating the MA-T research as a project, in which the students are only obligated to submit their work to a supervisor - who then makes a decision to ‘pass or fail’ the report - suggests that students may perceive that it is unnecessary to share their work with others, and in fact, that there are no explicit incentives for doing so (from an Organizational perspective, such as grades). Second, if the students are not obligated to share their research with others, there may be a perceived de-emphasis on the role of constructive feedback. In this case, the researcher argues that the ‘project’ status of the research emphasizes ‘showing what you know’ instead of a progression of ideas in which the emphasis is on explanatory power around competing ideas. This may also explain why many students did not take notice of the research abstracts of the students from the previous year, since there is little emphasis on progression of ideas; in other words, ‘showing what you know’ does not necessarily depend on knowing what your peers said that they ‘know’, the year before. Third, the project status of the research in which students are only accountable to one person for submitting their work (i.e., their supervisor) may reinforce a more traditional, didactic model of teaching in which the instructor tends to hold the balance of power as an authoritative source of knowledge. Therefore, the MA-T students may have been less likely to treat the ideas of their peers (and even the researcher-mentor to some extent, since she was not the one marking the research) in the same way that they would treat the ideas of their research supervisors.
The researcher suggests that the Organizational decision to have the student research be a ‘project’ and not a thesis has likely had many implications for the MA-T program as a whole, and specifically on the degree to which an open online research support forum was able to be of any significant use to students in supporting their work related to their research - and in particular, for supporting collaboration around the research. This is discussed further in the concluding chapter (Chapter 7).

**Students’ Perceived Impact of the SORSC**

In this section, the researcher begins with a description of some of the feedback from students regarding sharing their research, their use of the SORSC, and their use of the private online reflection journals. The researcher concludes the section by re-exploring some of the human factors discussed in Innovation 1 that likely continued to play a mediating role in outcomes during the second year of the design study.

**Student Feedback**

At the end of Innovation 2 of the design study, students were asked to complete a post-questionnaire which asked them to provide feedback on the process of carrying out their research in the MA-T program, and their reaction to the SORSC and the private online reflection journals (in the Psychology course) as a tool to help support their research. Out of the 38 student participants, 24 completed the questionnaire (63.2% response rate) (Table 10); of the 24 questionnaire respondents, 22 were students who chose to do the private online research journals as part of the Psychology course, and 9 were students who also copied their research journal into the SORSC.
At the time of the post-questionnaire (March 2008), all but one of the students had either completed their research project, or were in the process of completing their written report. As in the previous year, the frequency of meetings with supervisors varied from student to student, although most reported that they had met with their supervisors either monthly, or once or twice during the year (41.7%) to discuss their research. Other students reported meeting with their supervisor only a few times during the year, every other month, and only two students responded weekly or bi-weekly. Despite the variability of meetings with supervisors, most students agreed that they received sufficient support from their supervisor (83.3%). However, 91.7% also said that they felt they could have done a better job on the research project if they had more time to work on it, and 50.0% said they would have been willing to sacrifice one the four practicum
placements in the program in order to spend more time focusing on the research project. 

On a scale from 1 to 10 (1 being very poor quality, and 10 being very high quality), students, on average, rated the quality of their research project as a 7.3.

In total, 35 of the 38 student participants in the study opted to maintain the private online reflection journals for their Psychology course; the majority of which, focused on their research projects. Of these students - who also responded to the post-questionnaire ($n=22$) - 11 agreed that the online reflection journals was a useful assignment; 7 others disagreed and 4 responded ‘Not sure’. Slightly more (59.1%) responded that they ‘learned a lot through the process of reflecting in their online reflection journal’, 57.1% said they found it ‘helpful to be able to talk about their research in the online reflection journal’, and 81.8% agreed that they found the comments posted by the instructor to be helpful.

Despite the fact that 79.2% agreed that they ‘would have liked to hear more about the research that their peers were doing’, and approximately two thirds (66.7%) agreed that they would have liked more opportunities to discuss their research with their peers, none of the students opted to create a group view, or an open view in the SORSC in order to facilitate discussion about their research during the year. Table 11 and Table 12 summarize some of the other feedback obtained from students about their research, SORSC and the online reflection journals.

Table 11

<table>
<thead>
<tr>
<th>Student Feedback Regarding the MA-T Program and the Research Projects</th>
<th>Agree</th>
<th>Disagree</th>
<th>Not sure / Other</th>
<th>% Agreement ($n=24$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoyed conducting a research project as part of my program.</td>
<td>20</td>
<td>4</td>
<td>0</td>
<td>83.3%</td>
</tr>
</tbody>
</table>
I felt I could have done a better job on the research project if I had more time to work on it. 22 1 1 91.7%

There is so much required of students in the MT program that it makes it difficult to dedicate the time and energy necessary to do the research project. 21 3 0 87.5%

I think the MT research project is not given the same weight as a Master's thesis done in other education programs. 21 1 2 87.5%

I felt comfortable sharing my ongoing research with other students in my class. 18 3 3 75.0%

I think I shared common research interests with some of my peers. 15 4 4 62.5%

I would be more likely to share and discuss my ongoing research with others if I had more time to work on my research. 21 1 2 87.5%

In general, I am comfortable sharing my ideas-in-progress with others (ideas that aren't necessarily polished or perfect). 21 3 0 87.5%

In general, I preferred to work alone on my research. 10 12 2 41.7%

In general, I am more comfortable discussing my research with others, in person. 18 3 3 75.0%

In general, I am more comfortable discussing my research with others, in private. 13 6 5 54.2%

The following table summarizes feedback from those students who elected to do the online reflection journal as part of the Psychology course.

Table 12

Student Feedback on the Online Reflection Journals (Psychology Course)

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Disagree</th>
<th>Not sure / Other</th>
<th>% Agreement (n=22)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statement</td>
<td>Agree (n)</td>
<td>Neutral (n)</td>
<td>Disagree (n)</td>
<td>Percentage</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-----------</td>
<td>-------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>I learned a lot through the process of reflecting in my online journals.</td>
<td>13</td>
<td>7</td>
<td>2</td>
<td>59.1%</td>
</tr>
<tr>
<td>I found the comments posted by [names the instructor] in response to my online journal entries to be helpful.</td>
<td>18</td>
<td>3</td>
<td>1</td>
<td>81.8%</td>
</tr>
<tr>
<td>I found it helpful to be able to talk about my research in the online reflection journals.</td>
<td>12</td>
<td>9</td>
<td>1</td>
<td>57.1%</td>
</tr>
<tr>
<td>I liked the fact that the online reflection journals were private.</td>
<td>21</td>
<td>0</td>
<td>1</td>
<td>95.5%</td>
</tr>
<tr>
<td>I would have been reluctant to do the online reflection journals if they had been public (everyone in the class could read them).</td>
<td>19</td>
<td>3</td>
<td>0</td>
<td>86.4%</td>
</tr>
</tbody>
</table>

Feedback from the post-questionnaire seems to suggest that while many students felt that they had research interests in common with their peers (62.5%) and many would have liked to hear more about what others were working on (79.2%), close to half (41.7%) also admitted that they preferred to work alone on the research. Furthermore, approximately 41.7% of the students said that they were uncomfortable with some aspect of sharing their research (e.g., they are comfortable sharing, but only once the research is finished). This seems somewhat unusual given the fact that 75.0% said that they felt comfortable sharing their ongoing research with other students in their class. This seems to suggest that while many students were generally enthusiastic about sharing their research, they may have differed in the extent to which they were comfortable sharing, such as at different stages of the research process. Also, as in the previous year, there were a higher number of students that agreed that they were comfortable discussing their ideas in the weekly online discussion forum for their Psychology course (83.3%), despite
the fact that many described being uncomfortable with some aspect of sharing their research. This suggests, that students may find sharing their research ideas to be different from - and perhaps more difficult than - sharing their ideas around topics covered in their Psychology course.

Students tended to be more comfortable discussing their research in person (75.0%), and more than half said they were more comfortable discussing their research in private (54.2%). Privacy seemed to be even more important to students in the context of the online reflections journals since 95.5% admitted they liked the fact that the online reflection journals were private, and 86.4% said they would have been reluctant to do the online reflection journals if they had been public (everyone in class could read them). However, this may partially reflect students’ expectations and prior experiences with journals, which could suggest that they are private writing spaces, not public ones, as well as the fact that many were very personal and/or emotional in terms of their content.

**Human Factors Potentially Influencing Students’ Use of the SORSC**

As in Innovation 1 of the design study, although the SORSC was designed to take into account a number of relevant human factors in the MA-T program, Organizational constraints around time, and status of the student research in the program, as well as Psychological constraints pertaining to research competencies, and technology competencies may have had an impact on use, collaboration and perceived value of the SORSC and the online reflection journals.

Feedback from the post-questionnaire suggests that time is an important constraint with respect to the research projects in the MA-T program. In total, 87.5% of the respondents indicated that ‘there is so much required of students in the MT program that
it makes it difficult to dedicate the time and energy necessary to do the research project’ and 91.7% felt that they ‘could have done a better job on the research project’ if they had more time to work on it. As discussed elsewhere, this likely had an impact on students’ activity in the SORSC since they would have had little time to devote to discussing their research with others. It is probably the case, that for most students it was difficult enough to manage meeting with their supervisor and carrying out the research projects in light of all their other program obligations, and therefore the SORSC - even if it had been a potentially useful tool - would be a time luxury students could not afford. Furthermore, as previously mentioned, the status of the research - which is a ‘project’ and not a thesis - did not afford any explicit incentive for students to take the time to collaborate with others, since they were not required to share their research with anyone beyond their research supervisor.

According to the pre-questionnaire (response rate = 55.3%), administered at the beginning of the year, the majority of students (71.4%) indicated that they did not have any research experience beyond high school and/or university coursework, and 85.7% rated their research skills as ‘Novice’, ‘Below Average’ or ‘Average’. Although this would suggest that more students might have sought out research support through the SORSC, it may also suggest that many students would be unfamiliar with the emphasis placed in formal kinds of research on dissemination of research, the role of collaboration with respect to the progression of ideas, and the importance placed on the role of explanatory power of ideas.

Lastly, nearly half of the students (47.6%) rated their technology skills as either ‘Novice’, ‘Below Average’ or ‘Average’. This could potentially lead to fewer students
using the SORSC, although all of the students used Knowledge Forum® as part of their weekly online course discussions in Psychology and 79.2% said that the online discussion forum was easy to use. Furthermore, 85.7% said that they felt confident in their ability to participate in online discussions. As with students in the first year of the design study, many (66.7%) said that they often participate in online discussion (outside the SORSC), and data from Innovation 1 suggested that these students may be less inclined to participate in the open online research support forum.

**Summary**

In Innovation 2 of the design study, the researcher re-designed the open online research support forum based on outcomes from Innovation 1, and in light of the human factors identified in Phase 2. The second innovation in the design study took the form of a Student Online Research Support Centre (SORSC). The design of SORSC took into account the 24 initial constraints addressed in Innovation 1, with the addition of two new emergent constraints identified during the design study. In this chapter, the researcher outlined the results of Innovation 2 of the design study (Phase 3 of the research), carried out during the 2007-2008 academic year.

There were some aspects of the online research support that remained consistent between Innovation 1 and Innovation 2, and some design strategies that were new in Innovation 2. The main differences between Innovation 1 and Innovation 2 were: the use of private views for reflecting on the research projects as part of their expectations for the Psychology course, the reduction in the number of mentors from 6 to 1 (a mentor that they see regularly, face-to-face), elimination of the email notifications, a scaffolded
design around sharing to encourage collaboration between students around the research, and a change in the name of the online mentorship from the “Online Research Mentorship” (ORM) to the “Student Online Research Support Centre” (SORSC).

Although all of the constraints addressed in Innovation 1 were re-addressed in Innovation 2, many of the re-design features of the online research supports were guided by feedback from the first year of the design study (the Online Research Mentorship), as well as implications from the emergent constraints that were revealed. Generally, the researcher wanted to know whether the re-design strategy would be able to overcome some of the limitations in the previous design, specifically with respect to encouraging collaboration around the student research projects.

Results of the second year of the design study showed that the majority of students opted to discuss work related to their research in the private online reflection journals as part of their Psychology course. By mid-year, a small number of these students elected to copy their reflection journal into the SORSC in order to initiate additional feedback from the researcher-mentor. Although the researcher had hoped that this would encourage students to use the SORSC as a place to further discuss their research - and in particular, with their peers - this did not happen. Students did not post any notes in response to the researcher-mentor feedback, and most did not respond to initial feedback provided by the instructor throughout the year. Furthermore, none of the students opted to create group or open (public) views in the SORSC, and therefore there is no evidence to suggest that students actually collaborated around their research in this forum. It is possible that students discussed their research with their peers outside the SORSC however, given the fact that most students indicated (at the end of the year) that
they would have liked to hear more about what their peers were working on, it seems likely that their conversations were limited in some respects (e.g., limited to their immediate peer group, informal conversation rather than working on improving their ideas).

As in Innovation 1 of the design study, Organizational constraints around time and the status of the research projects within the MA-T program, in addition to Psychological constraints around privacy of ideas related to the research projects, likely played a key role in mediating the outcomes of student activity in the open online research support forum (both the ORM and SORSC) - in particular around collaboration. The design of SORSC specifically attempted to address the latter of these constraints, one of the emergent constraints from the previous year of the design study. By giving students the opportunity for both private and public workspace in the SORSC, it was hoped that this would encourage students to eventually share what, and when, they were most comfortable. However, the results suggest that while the private views encouraged personal reflection on work related to their research, the scaffolded design of SORSC was not able to support the gradual shift towards sharing ideas that was intended. The researcher would further suggest that the Organizational constraints around time and status of the research projects likely strongly reinforced the individual work that was happening in the private reflection views however, it also may have made it more likely that online discussion would not move beyond individual reflection towards collaboration through the scaffolded design in SORSC.

The next chapter summarizes the findings of the overall design study (Phase 3) in light of the human factors constraint analysis in Phase 2 of the research. The chapter will
also discuss the implications for a Human-Tech (Vicente, 2003) framework for technology integration in education - and in particular, teacher education - and implications for using a constraint-based tool such as Cognitive Work Analysis as a Design Research tool in the context of teacher education.
CHAPTER SEVEN: CONCLUSIONS AND IMPLICATIONS

Broadly, this design research study explores the impact of using a Human-Tech framework (Vicente, 2003) for understanding technology integration in education and specifically, to inform the design of technology-enhanced learning practices in the context of teacher education. Further to this, the research study reports on the impact of an open online research support forum - designed using a Human-Tech framework - on the experiences of teacher candidates while carrying out classroom-based research as part of their initial teacher education program. The goal of this research is twofold: 1) to explore the potential of using a Human-Tech framework for understanding technology integration in the context of teacher education and, 2) to examine the impact of a socio-technical tool (the open online research support forum) that was designed using a Human-Tech framework.

Summary of the Contributions of the Research

The contributions of the research fall into two categories: 1) local implications for the MA-T program, and 2) broader implications for theory with respect to technology integration, and around methodology with respect to using Cognitive Work Analysis as a means of implementing a Human-Tech framework. These contributions are briefly highlighted below and then expanded in the subsequent major sections that follow.

Local Implications of the Research

The following sections briefly outline the local implications of the research for the MA-T program, which was the context for the study. These implications grew out of both
the results of Phase 2 (CWA, including constraints not directly addressed as part of the
design study) and Phase 3 (the outcomes from the design study) of the research.

Supporting Academic Practices in a Teacher Education Context

Evidence from this research suggests:

1) There is a need to address students’ conceptions about conducting research,
and how it is different from other kinds of program work that may emphasize completion
of tasks as opposed to idea-centered work involving long-term, sustained effort and
progressive discourse around conceptual artefacts (Bereiter, 2002b).

2) If the MA-T program continues to require that students carry out a research
project, there is a need for provision of training on basic research methods, and how
classroom-based research differs from other kinds of educational research. This is
particularly important in the first year of the program, so that students can better prepare
for work related to carrying out their research projects in year two, and be in a position to
complete their research within the two-year duration of the program.

3) If the MA-T program continues to require that students carry out a research
project, there is a need for ongoing support in the second year of the program with
respect to the research- beyond research supervision. It should be noted that at the time of
the study, there was no second year course devoted to supporting the research. However,
support in year two may not necessarily be in the form of a course per se. For example,
support could also be in the form of (or combination of) participating in regular research
group meetings (including with other MA-T students, both in their first and second year
of the program), regular one-on-one meetings with supervisors, and/or online research
groups.
Building Stakeholder Consensus around Organizational Priorities

Evidence from this research suggests:

1) There is a need to build consensus around core values and priorities, so that the functional purpose(s) and objectives of the program are clearly understood among program stakeholders (both faculty and students). The research also suggests that existing faculty (and where feasible, students) be involved in the consensus-building process and that new faculty should be mentored into the program to help ensure continuity of goal-directed work around program objectives.

2) There is currently a perceived divide between “academic” and “non-academic” work in the program. The researcher argues that this divide is counter-productive to the current functional purpose of the program which is to prepare teachers to take on leadership roles through a combination of extended training and academic study, and perpetuates the common dichotomy that is reported to exist between theory and practice within education. Therefore, there is currently a need to place an increased priority on both academic and traditional teacher-training goals across all aspects of the program (e.g., building critical understanding of research across content areas such as curriculum and instruction, classroom management, etc. with an emphasis on how it informs practice). This might also include extending an academic focus within practice teaching (practicum).

3) There is a need to create better selection procedures with respect to admittance into the program, that are in line with the core values and functional priorities of the program (once these have been agreed upon). For example, if the MA-T program continues to require students to carry out research as part of the program, it would be
advisable to select students that have some prior experience with carrying out independent research or have engaged in work-related research projects, and who have an expressed interest in continuing to engage in research activity.

4) The MA-T program could consider offering multiple routes to completion within the program with respect to the research. For example, there could be a “thesis stream” in which students sacrifice their fourth practicum placement in order to focus on their research, and a “non thesis-stream” in which students do the typical four placements and complete a non-empirical research paper. Students would self-identify early in the program (or in the application process) as to which stream they would like to follow.

5) If the MA-T program continues to require all students to carry out research, there is a need to create organizational supports that build in time for the research during field placements. Although placement schools are aware of students’ obligations with respect to the research in the MA-T program, evidence suggests that the majority of practicum time is spent on teaching-related duties and assessment. Long-term, the MA-T program might consider selecting associate teachers (teacher practicum supervisors) who are considered exemplary models of practitioner-research (teachers who are actively engaged in things like professional learning communities, or school-university research partnerships) - perhaps, in part, by acquiring former MA-T graduates to serve as associate teachers after two or three years of teaching.

Use of Technology to Support Academic and Teacher Training Priorities

Evidence from this research suggests:

1) There is a need to familiarize students with various types of technologies, in addition to research literature that suggests technology’s potential to support teaching and
learning. The data from this research indicates that many students come in to the program with little to no prior experience with using technology.

2) There is a need to provide a framework for, and model (in practicum and within courses), technology-enhanced learning practices across contextually-variable conditions. Although there is some data to suggest that technology integration is a priority in the program, there is little evidence to suggest that all faculty and/or associate teachers are modeling best practices with respect to technology-enhanced learning.

3) If the MA-T program decides to place an increased priority on technology-enhanced learning practices, there is a need to provide training for faculty and associate teachers on the use of technologies that have the potential to support teaching and learning with respect to program-specific goals and priorities. Ideally, and where possible, students should be placed with associate teachers that actively engage in technology-enhanced teaching and learning practices - perhaps, in part, by acquiring former MA-T graduates to serve as associate teachers after two or three years of teaching.

Broader Implications of the Research

The following sections briefly outline the broader implications of the research for theory with respect to technology integration, and around methodology with respect to using Cognitive Work Analysis as a means of implementing a Human-Tech framework.

Frameworks for Understanding Technology Integration in Education

1) The findings from this thesis lend support to other research that has broadly considered the role of context in understanding technology integration, and in particular
in teacher education. Specifically, the researcher begins to answer the important - and arguably unexplored - question of how context ought to be used to inform design.

1a) Data from a two-year, research-based teacher education program suggests that in this context, there may be key Organizational constraints that need to be addressed in order to design more effective technological affordances for learning.

Cognitive Work Analysis as a Means of Implementing a Human-Tech Framework

2) This thesis demonstrates the development and field testing of a Human-Tech framework through the implementation of a modified approach to Cognitive Work Analysis, in the context of a two-year, research-based teacher education program.

2a) In particular, this research points to the need to find an approach to implementing a Human-Tech framework for technology integration that is time- and resource-effective, and that can reasonably be carried out by instructors and teachers, across a spectrum of educational settings (e.g., K to 12 - teacher education - and faculty development).

Expanding on the Local Research Implications

Supporting Academic Practices in a Teacher Education Context

The two-year academic model of teacher education is a relatively new model for teacher induction. The MA-T program formally began in 2000 as a result of a two-year pilot study looking at the potential of extended training for pre-service education. From a Communities of Practice perspective (Wenger, 1998), it is not clear that academic practice is necessarily considered part of the legitimate peripheral experiences normally
associated with teacher professional development. Therefore, the MA-T program has the
potential to provide a new model for understanding teacher induction that combines
theory and practice in new ways, such as by creating a closer relationship between
research-related priorities and practice-related priorities. However, with respect to
carrying out research as part of the program evidence from this study suggests that there
is a need to address students’ conceptions about conducting research, and how it is
different from other kinds of program work that may emphasize completion of tasks as
opposed to idea-centered work involving long-term, sustained effort and progressive
discourse around conceptual artefacts (Bereiter, 2002b). For example, the researcher has
argued that there are fundamental epistemological differences between project work and
the kind of work involved in research. Therefore, the Organizational decision to
emphasize the students’ research as a ‘project’ (and not a thesis) may have implications
for goal-directed work in the program. First, in research work, such as involved with
carrying out a thesis, there is usually an emphasis placed on sharing one’s ideas with
others (i.e., dissemination through research conferences, publications, and/or evaluation
by a research committee). By treating the MA-T research as a project, in which the
students are only obligated to submit their work to a supervisor - who then makes a
decision to ‘pass or fail’ the report - suggests that students may perceive that it is
unnecessary to share their work with others, and in fact, that there are no explicit
incentives for doing so (from an Organizational perspective, such as grades). Second, if
the students are not obligated to share their research with others, there may be a perceived
de-emphasis on the role of constructive feedback. In this case, the researcher argues that
the “project” status of the research emphasizes ‘showing what you know’ instead of a
progression of ideas in which the emphasis is on explanatory power around competing ideas. Third, the project status of the research in which students are only accountable to one person for submitting their work (i.e., their supervisor) may reinforce a more traditional, didactic model of teaching in which the instructor tends to hold the balance of power as an authoritative source of knowledge.

If the MA-T program continues to require that students carry out a research project, there is also a need for provision of training on basic research methods, and how classroom-based research differs from other kinds of educational research; or what others have described as “research in education” versus “research related to education” (Ball & Forzani, 2007). Data (self-reported) from this research suggests that as much as 91% of the students currently being enrolled in the program have only novice to average research-based competencies. Developing these skills is particularly important in the first year of the program, so that students can better prepare for work related to carrying out their research projects in year two, and also so they are in a position to complete their research within the two-year duration of the program. Furthermore, there is also a need for ongoing support in the second year of the program with respect to the research beyond research supervision. It should be noted that at the time of the study, there was no second year course devoted to supporting the research, when students typically carry out their data collection. Although students are generally satisfied with the support offered by their research supervisors, there is also evidence to suggest that students feel they could do a better job on their research if they had more time to spend working on it. In addition to provisions for time off to focus on their research, students might also benefit from things like: participating in regular research group meetings (including with other MA-T
students, both in their first and second year of the program), regular one-on-one meetings with supervisors, and/or online research groups. The chance to work with others on their research throughout the program could potentially have a positive impact on their efforts to collaborate around common research problems, as well as provide the means with which to support a better research induction process for new students.

**Building Stakeholder Consensus around Organizational Priorities**

It is unlikely that increased design strategies that focus on Psychological constraints, such as around developing students’ research competencies, is going to have any substantial and long-lasting impact on functional priorities around the academic component of the program without attention also being paid to Organizational and Team constraints around stakeholder consensus. Evidence from this research suggests that there is a need to build consensus around core values and priorities, so that the functional purpose(s) and objectives of the program are clearly understood among program stakeholders (both faculty and students). In particular, the human factors constraint analysis suggests that the faculty in the MA-T program each has their own perceptions about the student research projects, and in the absence of clear Organizational direction on this priority, each faculty member currently describes (and ultimately supports) the research in different ways. Although, it may be important to allow stakeholders some flexibility in making decisions about the ways in which goal-directed work is carried out, it is arguably equally important that there be clear functional priorities and objectives set in place around which stakeholders can direct their efforts. A lack of common focus is likely to result in a diffusion of stakeholder efforts, and therefore the ability to orchestrate collective goal-directed behaviour around functional priorities is lost. Since the
stakeholders in the MA-T program currently exhibit differences in their understanding of the kinds of goal-directed behaviour that is necessary in the program, the researcher suggests that existing faculty (and where feasible, students) be involved in the consensus-building process, and that new faculty be mentored into the program to help ensure continuity of goal-directed work around program objectives.

Once clear functional priorities have been established, selection procedures with respect to admittance into the program should be re-addressed so that they are in line with the core values of the program. For example, if the MA-T program continues to require students to carry out research as part of the program, it would be advisable to select students that have some prior experience with carrying out independent research or have engaged in work-related research projects, and who have an expressed interest in continuing to engage in research activity. Data (self-reported) from this research suggests that as many as 26% of the students currently being enrolled in the program would prefer not to carry out research. The MA-T program could consider offering multiple routes of study with respect to research, which could address some of this difference in the personal priorities of the students. For example, there could be a “thesis stream” in which students sacrifice their fourth practicum placement in order to focus on their research, and a “non thesis-stream” in which students do the typical four placements and complete a non-empirical research paper. Data (self-reported) from this research suggests that as many as 50% of the students currently enrolled in the MA-T program would be willing to sacrifice one of their practicum placements in order to focus more time on their research. Students could self-identify early in the program (or in the application process) as to
which stream they would like to follow, and this information could be used to help build appropriate supports for either route, across both years of the program.

With respect to goal-directed behaviour, evidence from this research suggests that there is currently a perceived divide between “academic” and “non-academic” work in the program, among students and faculty. The researcher argues that this divide is counter-productive to the current functional purpose of the program which is to prepare teachers to take on leadership roles through a combination of extended training and academic study, and perpetuates the common dichotomy that is reported to exist between theory and practice within education. Therefore, there is currently a need to place an increased priority on both academic and traditional teacher-training goals across all aspects of the program (e.g., building critical understanding of research across content areas such as curriculum and instruction, classroom management, etc. with an emphasis on how it informs practice). This could also include extending an academic focus within practice teaching (practicum).

Furthermore, evidence suggests that there is a need to create Organizational supports that build in time for the research during field placements. Although placement schools are aware of students’ obligations with respect to the research in the MA-T program, there is data that suggests that the majority of practicum time is currently spent on teaching-related duties and assessment. Furthermore, the human factors constraint analysis indicated that some associate teachers (teacher practicum supervisors) and/or principals at placement schools do not always fully support the MA-T students in carrying out their research during practicum (where most of the students’ data is collected). Long-term, the MA-T program might consider selecting associate teachers
who are considered exemplary models of practitioner-research (teachers who are actively engaged in things like professional learning communities, or school-university research partnerships) - perhaps, in part, by acquiring former MA-T graduates to serve as associate teachers after two or three years of teaching. The MA-T program could also consider structuring the student research around university-school partnership goals, such as to improve educational quality of life within K to 12 schools, since this is also likely to increase the perceived value of engaging in research from the perspective of the placement schools since the student research would directly inform their own school-related best practices.

**Use of Technology to Support Academic and Teacher Training Priorities**

Data from this research indicates that many of the MA-T students come to the program with little to no prior experience with technology. Therefore, this suggests that there is a need to familiarize students with various types of technologies, in addition to research literature that suggests technology’s potential to support teaching and learning.

In addition to learning more ‘about’ technology, the broader findings from this research suggests that there is a need to provide a framework for understanding how to structure effective technology-enhanced learning practices across contextually-variable conditions. The researcher suggests that the TPCK model offered by Koehler and Mishra (2008), with an increased emphasis on how contextual factors can be used to inform technology-enhanced learning practices, could be a good framework to support this objective.

Although there is some data to suggest that technology integration is a priority in the program, there is little evidence to suggest that all faculty and/or associate teachers
are modeling best practices with respect to technology-enhanced learning. In keeping with placing an increased priority on technology-enhanced learning practices, there is also a need to provide training for faculty and associate teachers on the use of technologies that have the potential to support teaching and learning with respect to program-specific goals and priorities. Ideally, and where possible, students should be placed with associate teachers that actively engage in technology-enhanced teaching and learning practices - perhaps, in part, by acquiring former MA-T graduates to serve as associate teachers after two or three years of teaching.

**Expanding on the Broader Research Implications**

*Frameworks for Understanding Technology Integration in Education*

Throughout this document, the researcher develops the argument for the need to go beyond models of technology integration that underestimate the scope and importance of context for design in education. In particular, there are current models of technology integration that do not provide the means with which to account for context in designing for technology-enhanced learning. Although others have indicated that context is important to understanding how to support effective ways of integrating technology into teaching and learning (Fishman, Marx, Blumenfeld, Krajcik, & Soloway, 2004; Koehler & Mishra, 2008), relatively little attention has been paid to how researchers and practitioners ought to go about using contextual information as a way to leverage technological affordances (Gibson, 1986; Norman, 1988). There is some work related to issues of equity (Kelly, 2008) that may provide some initial guidance in understanding the relationship between human social factors and technology design. However, the
researcher argues that it is also important to expand on more common definitions of constraints that reinforce a traditional ‘barrier’ or ‘deficit’ framework for guiding priorities around technology integration, to also see constraints as a means of guiding what is likely to become a technological affordance for a particular context, through a ‘design’ framework.

**Direct Implications for Teaching and Teacher Education**

The current study, suggests that in this context there may be Organizational constraints - definitions, expectations and priorities pertaining to academic study (e.g., carrying out research) - that need to be dealt with before Human-Tech affordances are likely to succeed in facilitating individual work around research, and ultimately to support one of the main goals of the system, which is to prepare teachers to take on leadership roles in education. In other contexts, the need to address the Organizational level may not be as imperative, but it may be particularly important for the MA-T context because of its emphasis on an academic component of study, which is not typical of most teacher education programs; or at least not to the same extent. Vicente (2003) claims that the higher Human-Tech levels (e.g., Political, Organizational) can impact the lower ones (Team, Psychological, Physical), however the relative degree of importance (and ability) of immediately addressing the Organizational level may vary from context to context. For example, designing better feedback systems on hospital medication intravenous (IV) machines to warn of a potential accidental overdose may take into account the possibility for human error during busy, and long working hours for nurses (providing a design solution at the level of Psychological constraints around stress and fatigue), however nurses who are overworked due to overly long hours that they are scheduled for shifts
(Organizational), may eventually take a toll somewhere else in the system. Therefore, for some systems the impact of the Organizational constraints may take a while to surface. However, in the MA-T program it seems as though problems at the level of Organizational constraints already pervade many other Team (e.g., faculty agreement on the purpose of the research in the program) and Psychological factors (e.g., students’ perceptions of how their research is valued in the program) within the system, and therefore this suggests that there needs to be a focus on developing consistency, and priorities around Organizational factors that may ultimately impact socio-technical design, and more broadly the ability to carry out the functional priorities of the program.

**Cognitive Work Analysis as a Means of Implementing a Human-Tech Framework**

Overall, results of the research study suggest that using a Human-Tech framework (Vicente, 2003) for understanding technology integration - through the implementation of a modified Cognitive Work Analysis (CWA) (Vicente, 1999) - was helpful in supporting a broader and more systematic approach to designing for more effective use of technology in the context of teacher education. While more work is needed to understand the long-term potential of using a Human-Tech approach to technology integration and design, the human factors constraint analysis offered through the implementation of the CWA allowed the researcher to choose which design criteria would be brought to the fore in the design process, as well as improved the means with which to reflect back on design when forming new innovative strategies. In this respect, the Human-Tech approach taken - through the application of a modified CWA - was well-suited to the design research methodology followed in this study. Although there are some factors within the system
that may remain hidden in the initial CWA procedure, and which may be revealed through the design research process in the form of emergent constraints, overall a constraint-based, Human-Tech framework for understanding technology integration helps address the problem of “counfoundedness” of the research setting within design experiments, originally highlighted by Brown (1992).

**Direct Implications for Teaching and Teacher Education**

One of the challenges with using an approach such as Cognitive Work Analysis (CWA) for supporting a Human-Tech framework for design in a teacher education context is access to stakeholders (during the CWA and also during the design study). Due to the fact that the researcher was unable to access the majority of key stakeholders until the start of the design study was problematic in that it limited the ability of the researcher to complete the human factors constraint analysis prior to design. This was further compounded by the fact that the university setting has policies in place to prevent instructors from making significant changes to their courses during the year (so that expectations are communicated up front and remain consistent), which limited the researcher’s ability to implement perturbations throughout the design study in order to address specific constraint priorities. These problems could potentially be solved by dedicating a full year to the CWA process and beginning the design study in the following year however, the drawback is that student stakeholders involved in the research during the CWA year would not be able to benefit from the design. Furthermore, design research is already a time-intensive process, and CWA - particularly when an entire academic year is devoted to it - only adds to this issue.
The problem of an approach to Human-Tech design that is time- and resource-intensive also has implications for practice since the need to consider context is not just a research problem. There is also a need to better understand how context can be brought to bear in making decisions about how to integrate technology into teaching from a practitioner perspective. Although Koehler and Mishra’s (2008) Technological Pedagogical Content Knowledge (TPCK) model takes into account context as a factor that needs to be considered and that will have an impact on technology-enhanced learning, the authors have provided little guidance in helping educators to understand how context can be used to inform their model. While the researcher does not suggest it would be feasible for teachers to engage in carrying out Cognitive Work Analysis, there are important implications for technology-enhanced learning that can be gleaned from practitioners having an understanding of these contextual constraints through research that has been done in other K to 12 educational work settings, and that may share similar attributes.

**Summary**

The question ‘What does technology afford for teaching and learning?’ is a physical problem; technologies are built to do certain things, and afford certain actions. However, the question ‘What are the affordances of technology for teaching and learning?’ is a Human-Tech problem; although a technology may afford certain actions, its value is ultimately determined by the degree to which it is able to afford particular actions, towards particular goals. Therefore, it is important for both researchers and practitioners to frame issues around implementation and sustainability of socio-technical
innovations in education within the view of supporting the goals and objectives that ultimately define a given (or desired) learning context. This is not to say that the sole purpose of innovation is to support existing practice, but merely to point out that socio-technical change appears to be a process of growth and shift, and not replacement. Furthermore, Vicente (2003) argues that the purpose of any tool, or more broadly innovation, is to ‘improve quality of life’, which implies that the definition of ‘what is possible’ cannot be understood without consideration for ‘what is’.

In the current study, the researcher began with the question ‘what is?’ by examining the socio-contextual factors that define a two-year, research-based teacher education program (MA-T program), which could provide insight into the design of more effective technology-enhanced learning practices. The researcher then explored the question ‘what is possible?’ by examining the implications of the behaviour-constraining factors in light of a problem identified in the learning system (i.e., supporting classroom-based research). The design of an open online research support forum was the culmination of the ability of an online discussion forum (Knowledge Forum®) to afford a record of shared ideas, over time, without the need to share physical space, and a comprehensive understanding of one of the primary goals of the MA-T program, which is to prepare teachers to take on leadership roles in education. This research is an account of how this Human-Tech relationship emerged.
REFERENCES

AACTE Committee on Innovation and Technology (2008). TPCK action for teacher education: It’s about time! (Afterword). In AACTE Committee on Innovation and Technology (Ed.), Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators (pp. 289-300). New York: Routledge.


TO: [Group Name]
FROM: Kimberley MacKinnon, Ph.D. Candidate
SUBJECT: Letter of Consent to Participate in University of Toronto Study

I am a doctoral student from the Ontario Institute for Studies in Education of University of Toronto (OISE/UT) and I will be conducting a research study in your class this year. As part of this research, I am investigating how networked technology can be used to help enhance discussion and learning for students. Specifically, I will be looking at how online communication technology (e.g. discussion forums) may help support collaborative learning and the ongoing development of teacher professional practice.

Previous research has shown that the use of technology to support student collaboration can have positive effects on learning, under the right conditions. However, more research is needed in order to understand the needs of teacher learning communities to better facilitate computer supported collaboration and professional development. As part of your course (and the focus of this study), you will be asked to engage in peer discussions using an online discussion forum called the Innovations in Teaching and Learning (ITL) Forum, which runs using a program called Knowledge Forum. In the ITL Forum you will be able to post electronic notes to your class, as well as read and discuss others’ notes. In addition, you will have access to research group views (folders) in which you will be able to access information related to completing your research project ([program name] program requirement). As part of the research groups in the ITL Forum you will also have access to a group of doctoral student research mentors, who will help answer questions about the research process and provide you with feedback and guidance as you progress through various stages of your project. In turn, the doctoral mentors will gain experience with the process of academic advising, something they will be doing when they assume academic faculty positions later on. Overall, it is my belief that the use of the online discussion forum will provide you with an opportunity to engage in collaborative teacher reflective practice and professional development.

All data entered in the course discussion forum, including the ITL Forum view, will later be analyzed as part of the study. You will also be asked to fill out short pre-, mid-study and post- questionnaires related to your research and use of the ITL Forum. Some students may also be selected to conduct interviews. Only myself, and my research committee will have access to any data that is collected, and at no time will any student’s name, or the name of the institution, be identified in published documents. Your instructor will not be informed of your decision to participate in the study. Furthermore, I believe that there are no real risks associated with participation in this study, and your grades will not be contingent on your performance or willingness to participate. Your participation and responses to any question in interviews and/or questionnaires are strictly voluntary. Students who do not wish to participate will still have the opportunity to engage in the ITL Forum, however, data will only be analyzed and reported from those who have given their consent. You also have the option to
withdraw from the study at any time, without consequence. All raw data will be kept in locked files, and will be destroyed within five years after the successful completion of the study.

If you are willing to participate in the study, please print your name, sign and date this form below.

<table>
<thead>
<tr>
<th>Name (Please PRINT)</th>
<th>(Signature)</th>
<th>(Date)</th>
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Yes, I am willing to participate in a short interview if I am asked (if yes, please check).

☐

I would like to have a short summary of the results of this study send to me via email.
Yes   No   (Circle One)

(If yes, please provide your email address):
(Please print clearly)

If you have any questions and/or concerns at any time, please do not hesitate to contact me, or my supervisor (see below).

Sincerely,

Kimberley MacKinnon, Ph.D. (Candidate), Curriculum, Teaching and Learning
Phone: [Phone]   Email: [Email]
[Supervisor: Dr. Earl Woodruff, [Phone], [Email]]
APPENDIX B: Faculty Consent Letter, 2006-2007

TO: [Group Name] Faculty and Staff
FROM: Kim MacKinnon, Ph.D. Candidate, OISE/University of Toronto
SUBJECT: Letter of Consent to Participate in University of Toronto Study

I am a doctoral student from the Ontario Institute for Studies in Education of University of Toronto (OISE/UT) and I will be conducting a research study in the [program name] program beginning in September 2006. As part of this research, I am investigating how networked technology can be used to help enhance discussion and learning for students. Specifically, I will be looking at how online discussion forums, as well as handheld computer technology (such as Palm™ Pilots), may help support collaborative learning and the ongoing development of teacher professional practice.

Previous research has shown that the use of technology to support student collaboration can have positive effects on learning, under the right conditions. However, more research is needed in order to understand the needs of teacher learning communities to better facilitate computer supported collaboration and professional development. As part of the current study, the [program name] class will be asked to engage in peer discussions using an online discussion forum, called Knowledge Forum, in which they will be able to post electronic notes, as well as read and discuss others’ notes. It is my belief that, under the right conditions, the use of the online discussion forum will provide the [program name] students with an opportunity to engage in collaborative teacher reflective practice and professional development.

All data entered in the discussion forum will later be analyzed as part of the study. You and the [program name] students will also be asked to fill out a short pre- and post-questionnaire. Furthermore, you and some of the [program name] students will be selected to conduct interviews (approx. 40 minutes) that will be audio recorded and later transcribed for analysis. Only myself, and my research committee will have access to any data that is collected, and at no time will any student’s name, or the name of the institution, be identified in published documents. In the interest of protecting confidentiality and avoiding perceived conflicts of interest, you will not be informed of any student’s decision to participate (or not participate) in the study. Furthermore, I believe that there are no real risks associated with participation in this study, and students will be informed that their grades will not be contingent on their performance or willingness to participate. Yours and the [program name] students’ participation and responses to any question in interviews and/or questionnaires are strictly voluntary. Students who do not wish to participate will still have the opportunity to engage in the online discussion forum, however, data will only be analyzed and reported from those who have given their consent. Students will also have the option to withdraw from the study at any time, without consequence. All raw data will be kept in locked files, and will be destroyed within five years after the successful completion of the study.

If you are willing to participate in the study, please print your name, sign and date this form below.
Yes, I am willing to participate in a short interview if I am asked (if yes, please check). □

I would like to have a short summary of the results of this study send to me via email.
Yes □  No □  (Check One)

(If yes, please provide your email address: ______________________) (Please print clearly)

If you have any questions and/or concerns at any time, please do not hesitate to contact me, or my supervisor (see below).

Sincerely,

Kimberley MacKinnon, Ph.D. (Candidate), Curriculum, Teaching and Learning
Phone: [Phone]  Email: [Email]
[Supervisor: Dr. Earl Woodruff, [Phone], [Email]]
**APPENDIX C: Mentor Consent, 2006-2007**

**TO:** Doctoral Students  
**FROM:** Kimberley MacKinnon, Ph.D. Candidate  
**SUBJECT:** Letter of Consent to Participate in University of Toronto Study

I am a doctoral student from the Ontario Institute for Studies in Education of University of Toronto (OISE/UT) and I am investigating how networked technology can be used to help enhance discussion and learning for students. Specifically, I am looking at how online communication technology (e.g. discussion forums) may help support collaborative learning and the ongoing development of teacher professional practice.

The final part of my research will be examining the impact and usefulness of an online research mentorship program. As part of this line of inquiry, the **Innovations in Teaching and Learning (ITL) Forum** is currently being designed to help pre-service students get the support they need to complete research studies as part of their teacher education programs. Through the help of an online discussion forum environment (Knowledge Forum), pre-service students will have access to resources about research, and to doctoral research mentors. These mentors (which would be your role) are there to help answer questions, facilitate the research design process (e.g., help them develop informed, researchable questions), and to provide feedback on written work as students progress through the research stages (e.g., on a draft of a literature review).

I would reasonably expect this mentorship position to take approximately an average of 2 hours a week, or 100 hours in total over an 8 month period (Sept 2006 to Apr 2007). The workload will likely vary from week to week; some weeks there will be no activity in the ITL Forum and some weeks there may be a flurry of messages. The pre-service students will be divided up among the mentors – to ease workload and help ensure that each student gets attended to in the forum. So, on average each mentor might be responsible for monitoring approximately 5 to 8 students; this may be less depending on the number of mentors volunteering to participate. You will be given full training on using the Knowledge Forum online discussion forum (ITL Forum), and the faculty supervisor [name], and myself, will be available to help answer questions and provide guidance on online mentorship throughout the year. At the end of the year, [name] will provide a **letter of recommendation** for your role as a research mentor, for you to add to your academic CV/teaching portfolio.

All data entered in the ITL Forum will later be analyzed as part of the study. You will also be asked to fill out a short pre- and post- questionnaire. Some of you may also be selected to conduct interviews. Only myself, and my research committee will have access to any data that is collected, and **at no time will any student’s name, or the name of the institution, be identified in published documents.** Furthermore, I believe that there are no real risks associated with participation in this study, and your **grades will not be contingent on your performance or willingness to participate.** Your participation and responses to any question in interviews and/or questionnaires are **strictly voluntary.** You also have the **option to withdraw from the study at any time,**
without consequence. All raw data will be kept in locked files, and will be destroyed within five years after the successful completion of the study.

If you are willing to participate in the study, please print your name, sign and date this form below.

_________________________  ____________________________  ____________________________
Name (Please PRINT)        (Signature)                  (Date)

Yes, I am willing to participate in a short interview if I am asked (if yes, please check).
☐

I would like to have a short summary of the results of this study send to me via email. Yes  No  (Circle One)

(If yes, please provide your email address):
(Please print clearly)

If you have any questions and/or concerns at any time, please do not hesitate to contact me, or my supervisor (see below).

Sincerely,
Kimberley MacKinnon, Ph.D. (Candidate), Curriculum, Teaching and Learning
Phone: [Phone]   Email: [Email]
[Supervisor: Dr. Earl Woodruff, [Phone], [Email]]
APPENDIX D: Student Consent Letter, 2007-2008

TO: [Group Name], 2007-2008
FROM: Kimberley MacKinnon, Ph.D. Candidate
SUBJECT: Letter of Consent to Participate in University of Toronto Study

I am a doctoral student from the Ontario Institute for Studies in Education of University of Toronto (OISE/UT) and I will be conducting a research study in your class this term. As part of this research, I am investigating how networked technology can be used to help enhance discussion and learning for students. Specifically, I will be looking at how online communication technology (e.g. discussion forums) may help support collaborative learning and the ongoing development of teacher professional practice.

Previous research has shown that the use of technology to support student collaboration can have positive effects on learning, under the right conditions. However, more research is needed in order to understand the needs of teacher learning communities to better facilitate computer supported collaboration and professional development. As part of your course (and the focus of this study), you will be asked to engage in peer discussions using online communication technology (e.g., a discussion forum, called Knowledge Forum®), in which you will be able to post electronic notes, as well as read and discuss others’ notes. As part of the online discussion forum, one of the things you will have access to is a research view (folder) called the Student Online Research Support Centre (SORSC), in which you will be able to access online resources and information related to completing your research project ([program name] program requirement). In the SORSC view you will also have access to a research support person (Kim MacKinnon), who will help answer questions about the research process and provide you with feedback as you progress through various stages of your project. Overall, it is my belief that the use of the online discussion forum will provide you with an opportunity to engage in collaborative teacher reflective practice and professional development.

All data entered in the discussion forum (main course forum and SORSC), will later be analyzed as part of the study. You will also be asked to fill out a short pre- and post-questionnaire. Some students may also be selected to conduct interviews. Only myself, and my research committee will have access to any data that is collected, and at no time will any student’s name, or the name of the institution, be identified in published documents. Your instructor will not be informed of your decision to participate in the study. Furthermore, I believe that there are no real risks associated with participation in this study, and your grades will not be contingent on your performance or willingness to participate. Your participation and responses to any question in interviews and/or questionnaires are strictly voluntary. Students who do not wish to participate will still have the opportunity to engage in the online discussion forum, however, data will only be analyzed and reported from those who have given their consent. You also have the option to withdraw from the study at any time, without consequence. All raw data will be kept in locked files, and will be destroyed within five years after the successful completion of the study.
If you are willing to participate in the study, please print your name, sign and date this form below.

Name (Please PRINT)       (Signature)       (Date)

Yes, I am willing to participate in a short interview if I am asked (if yes, please check).

☐

I would like to have a short summary of the results of this study send to me via email.
Yes  No  (Circle One)

(If yes, please provide your email address):
(Please print clearly)

If you have any questions and/or concerns at any time, please do not hesitate to contact me, or my supervisor Dr. Earl Woodruff (see below).

Kimberley MacKinnon, Doctoral Candidate (Primary Investigator)
Dept. Curriculum, Teaching and Learning
Phone: [Phone]
Email: [Email]

Dr. Earl Woodruff (Supervisor)
Dept. Human Development and Applied Psychology
Phone: [Phone]
Email: [Email]

Furthermore, if at any time you have questions regarding your rights as a participant in a research study you may contact [university research office] by phone at [number] or by email to [email].

Thank you in advance for your consideration.

Kim MacKinnon, Doctoral Candidate
Dept. Curriculum, Teaching and Learning
OISE/University of Toronto
APPENDIX E: Cognitive Work Analysis, Student Interview

Work Domain

Describe for me, from beginning to end, what has to be done in order to be a successful student in the [program name]?

What would you say the [program name] was designed to achieve? Was there a specific need within the education community that the [program name] was designed to address?

What would you say is your job, or role, as a student in the [program name]?

Can you tell me about a typical day in your life as an [program name] student here at [name of university]? You wake up in the morning and…

(I noticed you mention some tools that you use, like a computer). What would you say are some of the tools that you use the most, or that are most useful to you in your job/role, as a student in the [program name]?

What tools do you find to be the least useful, or that tend to slow you down?

Environment

What sorts of laws/regulations/policies are you aware of that affect your job/role as a student in the [program name]?

Where are some of the common places you tend to do your work (office, home, library)? Where do you tend to do most of your work for your job?

Values and Priorities

What are some of the ways you determine whether you are successful in your job/role as a student in the [program name]? What are the indicators of success as a student in the [program name]?

What would you say are your top three priorities for succeeding in your job/role as a student in the [program name]?

Is there something that you feel you need to place particular emphasis on in the coming year/semester in order to be successful at your job/role as a student in the [program name]? Or is there something that you need help with in order to succeed?

What would you say is your own personal mission statement for success in the [program name]?

Social Organization
Who are all the people (professors, researchers, other students, practicum teachers) that have an impact on your job/role as a student in the [program name]? What roles do they play in your job/role as a student in the [program name]?

Who are the various people you communicate with most during the day in your job/role as a student in the [program name]?

What are the ways that you maintain communication (or stay in touch with) those people?

**Strategies** (Critical decisions)

Can you think of a time in your job/role as a student in the [program name] when you felt you were not successful (maybe you were failing at something or you were having trouble learning something)? A time when you had to make a critical decision about how to help yourself in your job/role as a student…

Can you describe that time and what you did to make things better?

**Control Task Analysis**

Is there anything that you find you need to happen first in order to go about your job/role as a student in the [program name]? Or something that you are often waiting to happen?

**Worker Competencies**

What do you think is important to know, or what skills are important to have, in order to be successful at your job/role as a student in the [program name]?

*Values*

What would you say is your own personal mission statement for success in the [program name]?

Design Question: Online Mentorship

Now that you’ve had a chance to see and/or participate within the online mentorship, how do you expect the online mentorship to impact your experience within the [program name]?
APPENDIX F: Cognitive Work Analysis, Faculty Interview

Work Domain

Describe for me, from beginning to end, what has to be done to be successful in the [program name] at [name of university]? (as a student, as a faculty member…)

What would you say the [program name] was designed to achieve? Was there a specific need within the education community that the [program name] was designed to address?

What would you say is your job, or role, within the [program name]?

What courses do you teach in the [program name]?

How do you think your course(s) fits into the overall purpose of the [program name]?

Why are students required to take your course?

Can you tell me about a typical day in your job in the [program name]? You wake up in the morning and…

(I noticed you mention some tools that you use, like a computer). What would you say are some of the tools that you use the most, or that are most useful to you in your job in the [program name]?

What tools do you find to be the least useful, or that tend to slow you down?

Environment

What sorts of laws/regulations/policies are you aware of that affect your job, or that you need to consider in your job, in the [program name]?

Where are some of the common places you tend to do your job (office, home, library)? Where do you tend to do most of your work for your job?

Values and Priorities

What are some of the ways you determine whether you are successful in your job in the [program name]?

What would you say are your top three priorities for being successful at your job in the [program name]?

What do you think are the indicators of success as a student in the [program name]?
Is there something that you feel you need to place particular emphasis on in the coming year/semester in order to be successful in your job? Or is there something that you need help with in order to succeed?

What would you say is your own personal mission statement for success in your job in the [program name]?

**Social Organization**

Who are all the people (professors, researchers, students, practicum teachers, other instructors) that have an impact on your job in the [program name]? What are the particular roles they play in your job?

Who are the various people you communicate with the most as part of your job in the [program name]?

What are the ways in which you maintain communication (or stay in touch with) those people?

**Strategies** (Critical decisions)

Can you think of a time in your job in the [program name] when you felt you were not successful, or you were having difficulty with some aspect of your job? A time when you had to make a critical decision about something to do with your job…

Can you describe that time and what you did to make things better?

**Control Task Analysis**

Is there anything that you find you need to happen first in order to go about your job in the [program name]? Or something that you are often waiting to happen?

**Worker Competencies**

What do you think is important to know, or what skills are important to have in order to be successful at your job in the [program name]?

What do you think is important to know, or what skills are important to have in order to be successful as a student in the [program name]?
APPENDIX G: Student Pre-Survey, 2006-2007

**Student Pre Questionnaire**

1. Research Experience

* 1. Please select your name from the class list.

* 2. What kind of prior experience do you have with conducting research (check all that apply)?
  - [ ] I have no prior experience with conducting research
  - [ ] Undergraduate thesis
  - [ ] Graduate thesis
  - [ ] High school course related research project(s)
  - [ ] University course related research project(s)
  - [ ] Research assistant
  - [ ] Other (please specify)

* 3. Which research methodologies are you familiar with?
  - [ ] Qualitative
  - [ ] Quantitative
  - [ ] Mixed methods
  - [ ] Design research
  - [ ] Action research
  - [ ] Other (please specify)

* 4. What research stages have you completed for the research project (check all that apply)?
  - [ ] I have not yet started my research project
  - [ ] I have a general idea of the area of research I want to pursue
  - [ ] I have formed my research question(s)
  - [ ] I have conducted a literature review
  - [ ] I have collected some pilot data (preliminary investigation)
  - [ ] I have designed my method and data collection tools
  - [ ] I have collected data
  - [ ] I have analyzed my data
  - [ ] I have begun writing up my final research project
5. Do you have a faculty research advisor/supervisor for the research project?
   - Yes
   - No
   - Not sure

6. How often have you discussed your research project with your faculty research advisor/supervisor?
   - I do not yet have an advisor/supervisor
   - I have not discussed my project with my advisor/supervisor
   - I have discussed my project with my advisor/supervisor once or twice
   - I discuss my project with my advisor/supervisor monthly
   - I discuss my project with my advisor/supervisor weekly
   - I discuss my project with my advisor/supervisor daily
   - Other (please specify)

7. Overall, how would you rate your skills at conducting research?
   - Novice
   - Below Average
   - Average
   - Above Average
   - Expert

8. How likely are you to go on to do doctoral studies at some point after completing the program?
   - Extremely Unlikely
   - Unlikely
   - Likely
   - Extremely Likely
   - Not sure

2. Research Related Statements

Please select the answer that best represents your stance on the following statements.
9. I feel confident that I have the skills to carry out and complete the research project.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

10. I would feel more confident about carrying out and completing the research project if I had regular access to a research advisor/ supervisor.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

11. I would feel more confident about carrying out and completing the research project if I had regular access to a research group in which I could talk about my research.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

12. I am looking forward to carrying out my research project.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

13. I would prefer to NOT have to carry out a research project as part of the program.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

14. I think the results of my research project will inform my own teaching practices.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

15. I think the results of my research project will contribute valuable knowledge to the larger education community.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

16. Teachers should not necessarily be expected to conduct research on a regular basis, but they should be expected to continuously keep up to date with current research and consider its application to practice.

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

17. I believe teacher/action research is an important element of professional self reflection (reflective practice).

   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
18. Teachers should be expected to engage in teacher/action research regularly as an element of professional reflection and best practice.

19. Teachers should engage in teacher/action research only if they feel it is important to them; it should not necessarily be expected as an element of good practice (best practice).

20. I intend to carry out teacher/action research throughout my teaching career.

21. I believe the goal of teacher/action research should primarily be to inform one’s own practice, not necessarily to inform broader theoretical perspectives or more general educational problems/issues.

22. Ultimately, teacher/action research is a process of individual, professional self reflection.

23. I believe that teacher/action research should inform broader theoretical perspectives or more general educational problems/issues, not just one’s own practice.

24. It is important for teacher/action research to be shared with the broader education community (other teachers, researchers, etc.)

25. I think teachers should participate in collaborative educational research communities on a regular basis.
26. On a scale from 1 to 10 (1 is very poor quality; 10 is very high quality) what do you anticipate will be the overall quality of your research project? 

27. Do you have access to a computer at home? 

Yes  
No

28. Do you have access to the Internet at home? 

Yes  
No

29. Have you ever taken an online course? 

Yes  
No

30. Have you ever participated in an online discussion (e.g., chat rooms, discussion forums)? 

Yes  
No

31. How often do you use a computer? 

Never  Extremely Seldom  Somewhat Seldom  Somewhat Often  Often  Extremely Often

32. How often do you use the Internet? 

Never  Extremely Seldom  Somewhat Seldom  Somewhat Often  Often  Extremely Often

33. How often do you use email? 

Never  Extremely Seldom  Somewhat Seldom  Somewhat Often  Often  Extremely Often

34. How often do you participate in online discussions (e.g., chat rooms, discussion forums)? 

Never  Extremely Seldom  Somewhat Seldom  Somewhat Often  Often  Extremely Often
35. Please check the following computer-related skills that you consider yourself to be able to do (check all that apply):
- Open a file
- Close a file
- Save a file
- Enter text words
- Delete spaces
- Copy and paste text from another document
- Draw a picture using graphics
- Use a CD-ROM
- Print
- Install a program
- De-install a program
- Troubleshooting computer problems
- Understanding words/terms relating to computer hardware
- Understanding words/terms relating to computer software

36. Overall, how would you rate your computer skills?
- Novice
- Below Average
- Average
- Above Average
- Expert

4. Computer Related Statements

Please select the answer that best represents your stance on the following statements.

37. I feel confident in my ability to use computers.
- Strongly Agree
- Agree
- Somewhat Agree
- Not sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

38. I feel confident in my ability to use the Internet to search for information.
- Strongly Agree
- Agree
- Somewhat Agree
- Not sure
- Somewhat Disagree
- Disagree
- Strongly Disagree
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<th>Question</th>
<th>Strongly</th>
<th>Disagree</th>
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<th>Not sure</th>
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<th>Agree</th>
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<td>* 39. I feel confident in my ability to participate in online discussions (e.g., chat rooms, discussion forums).</td>
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<td>* 40. I do not feel comfortable participating in online discussions (e.g., chat rooms, online discussion forums).</td>
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<td>* 41. I am confident about integrating technology into my teaching.</td>
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<td>* 45. I do not need training on how to integrate technology into my teaching.</td>
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<tr>
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<td>* 48. I think technology plays a vital role in teaching.</td>
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APPENDIX H: Student Pre-Survey, 2007-2008

Student Pre Questionnaire 07-08

1. Background

* 1. Please select your name from the class list.

* 2. What is your age?

* 3. What is your highest level of education completed (prior to the program)?
   - college diploma and/or professional apprenticeship
   - undergraduate degree
   - master’s degree
   - doctoral degree
   - post doc

* 4. What was your area of specialization in your prior education?
   - science (e.g., biology, chemistry, physics, astronomy, animal sciences, zoology)
   - social science (e.g., psychology, sociology)
   - humanities (e.g., history, linguistics)
   - early childhood education
   - professional training (e.g., nursing, dental assistant, legal assistant)
   - business
   - computer science
   - fine arts (e.g., music, drama, dance, visual arts)
   - Other (please specify)

* 5. On average, how long does it take you to travel to every day (one way)?
   - under 15 minutes
   - 15 to 30 minutes
   - 30 to 45 minutes
   - 45 to 60 minutes
   - over 60 minutes
* 10. What research stages have you completed for the research project (check all that apply)?
   - [ ] I have not yet started my research project
   - [ ] I have a general idea of the area of research I want to pursue
   - [ ] I have formed my research question(s)
   - [ ] I have conducted a literature review
   - [ ] I have collected some pilot data (preliminary investigation)
   - [ ] I have designed my method and data collection tools
   - [ ] I have collected data
   - [ ] I have analyzed my data
   - [ ] I have begun writing up my final research project

* 11. Do you have a faculty research advisor/supervisor for the research project?
   - [ ] Yes
   - [ ] No
   - [ ] Not sure

* 12. How often have you discussed your research project with your faculty research advisor/supervisor?
   - [ ] I do not yet have an advisor/supervisor
   - [ ] I have not discussed my project with my advisor/supervisor
   - [ ] I have discussed my project with my advisor/supervisor once or twice
   - [ ] I discuss my project with my advisor/supervisor monthly
   - [ ] I discuss my project with my advisor/supervisor weekly
   - [ ] I discuss my project with my advisor/supervisor daily
   - [ ] Other (please specify)

* 13. Overall, how would you rate your skills at conducting research?
   - [ ] Novice
   - [ ] Below Average
   - [ ] Average
   - [ ] Above Average
   - [ ] Expert
* 14. How likely are you to go on to do doctoral studies at some point after completing the program?

- Extremely Unlikely
- Unlikely
- Likely
- Extremely Likely
- Not sure

2. Program Related Questions

* 15. The program was designed to increase teacher confidence by providing an additional year of training.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 16. The program was designed to increase teacher job retention by providing an additional year of preparation.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 17. The program was designed to create leaders in the field of teaching.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 18. The program is highly regarded within the OISE/UT community.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 19. The program is highly regarded outside the OISE/UT community.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 20. In the program, there is a strong emphasis on doing well in the practicum placements.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree

* 21. In the program, there is a strong emphasis on getting good grades.

- Strongly Agree
- Agree
- Somewhat Agree
- Not Sure
- Somewhat Disagree
- Disagree
- Strongly Disagree
22. In the program, there is a strong emphasis on creating teacher-researchers.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

23. Of all the components of the program (courses, practicum, research, workshops), the majority of emphasis is placed on having successful practicum placements.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

24. Ultimately, the main purpose of the program is to produce teachers with strong teaching skills.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

25. Students in the program tend to be “high achievers”.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

26. Students take their performance very seriously in the program and as a result, at times we can be a bit competitive with each other.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

27. I feel I have a good understanding of the ideas and opinions of my peers in the program.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

28. I can often anticipate the ideas and opinions of my peers in the program, before they have expressed them.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

29. I feel very comfortable with my peers in the program.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

30. At times, assignments in the program seem more like “busywork” that don’t necessarily require deep, reflective thought.  

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not Sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
* 31. We are invited and encouraged to provide critical feedback to faculty teaching in the program.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 32. As a student in the program, I feel our opinions are heard by faculty and our ideas are taken seriously.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 33. Our research projects are highly regarded by the OISE/UT community.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 34. The research projects are not as highly regarded as other graduate research at (e.g., Master of Arts thesis).

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 35. We often receive mixed messages from faculty about the purpose of the research project and what it should look like.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 36. We all share a very clear and common underlying purpose (or objective) for research component of the program.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 37. Because there is so much to do in the program, my research often takes “the back burner” to other priorities (i.e., work on the research gets postponed, or delayed).

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 38. There are a lot of assignments in the program, and so I tend to prioritize them based on when they are due to be handed in.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

39. Do you have any other comments or feedback regarding the program?

3. Research Related Statements
Please select the answer that best represents your stance on the following statements.

* 40. I feel confident that I have the skills to carry out and complete the research project.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 41. I would feel more confident about carrying out and completing the research project if I had regular access to a research advisor/ supervisor.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 42. I would feel more confident about carrying out and completing the research project if I had regular access to a research group in which I could talk about my research.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 43. I am looking forward to carrying out my research project.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 44. I would prefer to NOT have to carry out a research project as part of the program.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 45. I think the results of my research project will inform my own teaching practices.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 46. I think the results of my research project will contribute valuable knowledge to the larger education community.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 47. Teachers should not necessarily be expected to conduct research on a regular basis, but they should be expected to continuously keep up to date with current research and consider its application to practice.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
48. I believe teacher/action research is an important element of professional self reflection (reflective practice).

49. Teachers should be expected to engage in teacher/action research regularly as an element of professional reflection and best practice.

50. Teachers should engage in teacher/action research only if they feel it is important to them; it should not necessarily be expected as an element of good practice (best practice).

51. I intend to carry out teacher/action research throughout my teaching career.

52. I believe the goal of teacher/action research should primarily be to inform one's own practice, not necessarily to inform broader theoretical perspectives or more general educational problems/issues.

53. Ultimately, teacher/action research is a process of individual, professional self reflection.

54. I believe that teacher/action research should inform broader theoretical perspectives or more general educational problems/issues, not just one's own practice.

55. It is important for teacher/action research to be shared with the broader education community (other teachers, researchers, etc.).
* 56. I think teachers should participate in collaborative educational research communities on a regular basis.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 57. On a scale from 1 to 10 (1 is very poor quality; 10 is very high quality) what do you anticipate will be the overall quality of your research project?
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

4. Technology Experience

* 58. Do you have access to a computer at home?
- Yes
- No

* 59. Do you have access to the Internet at home?
- Yes
- No

* 60. Have you ever taken an online course?
- Yes
- No

* 61. Have you ever participated in an online discussion (e.g., chat rooms, discussion forums)?
- Yes
- No

* 62. How often do you use a computer?
- Never
- Extremely Seldom
- Seldom
- Somewhat Seldom
- Often
- Somewhat Often
- Extremely Often

* 63. How often do you use the Internet?
- Never
- Extremely Seldom
- Seldom
- Somewhat Seldom
- Often
- Somewhat Often
- Extremely Often

* 64. How often do you use email?
- Never
- Extremely Seldom
- Seldom
- Somewhat Seldom
- Often
- Somewhat Often
- Extremely Often
* 65. How often do you participate in online discussions (e.g., chat rooms, discussion forums)?

☐ Never ☐ Extremely Seldom ☐ Seldom ☐ Somewhat Seldom ☐ Somewhat Often ☐ Often ☐ Extremely Often

* 66. Please check the following computer-related skills that you consider yourself to be able to do (check all that apply):

☐ Open a file
☐ Close a file
☐ Save a file
☐ Enter text words
☐ Delete spaces
☐ Copy and paste text from another document
☐ Draw a picture using graphics
☐ Use a CD-ROM
☐ Print
☐ Install a program
☐ De-install a program
☐ Troubleshooting computer problems
☐ Understanding words/terms relating to computer hardware
☐ Understanding words/terms relating to computer software

* 67. Overall, how would you rate your computer skills?

☐ Novice
☐ Below Average
☐ Average
☐ Above Average
☐ Expert

5. Computer Related Statements

Please select the answer that best represents your stance on the following statements.

* 68. I feel confident in my ability to use computers.

☐ Strongly Disagree ☐ Disagree ☐ Somewhat Disagree ☐ Not sure ☐ Somewhat Agree ☐ Agree ☐ Strongly Agree
* 69. I feel confident in my ability to use the Internet to search for information.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 70. I feel confident in my ability to participate in online discussions (e.g., chat rooms, discussion forums).
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 71. I do not feel comfortable participating in online discussions (e.g., chat rooms, online discussion forums).
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 72. I am confident about integrating technology into my teaching.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 73. I intend to integrate technology into my teaching.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 74. I would be more likely to integrate technology into my teaching if I had more training and experience using different types of technology.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 75. Given a learning goal, I am able to develop ideas for integrating technology into my lesson plans.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 76. I do not need training on how to integrate technology into my teaching.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 77. A lack of knowledge about technology will limit a teacher’s ability to teach effectively.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 78. I would be difficult to teach without the use of technology.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
79. I think technology plays a vital role in teaching.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

80. It would be difficult to do research without the use of technology.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

81. I think technology plays a vital role in conducting research.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
APPENDIX I: Faculty Survey, 2006-2007

* 7. Overall, how prepared do you think the students are to conduct empirical research?

Faculty Research & Technology Questionnaire

1. Questions About The Students

* 1. First Name [ ]

* 2. Last Name [ ]

* 3. Approximately how many of the students did you supervise last year for the research project? [ ]

* 4. Last year, approximately how many of the students' research projects were supervised by other faculty from OUTSIDE the program? [ ]

* 5. On average, how often did each of the students (that you were supervising) consult you on their research projects? [ ]
   - Never
   - Once or twice over the year
   - Monthly
   - Weekly
   - Daily
   - Other (please specify) [ ]

* 6. What were the most common modes of communication you used with the students for talking about their research (select all that apply)?
   - Face to Face [ ]
   - Phone [ ]
   - Email [ ]
   - Online discussion forum [ ]
   - I had no communication with students about their research prior to them submitting the final project [ ]
   - Other (please specify) [ ]
* 10. In previous years, what were some of the most common problems the students were having with their research projects (select all that apply)?

- Literature review
- Defining their research questions
- Finding/designing appropriate method or tools
- Gathering enough data
- Analysis
- Write up - technical (formatting, spelling, grammar, structure)
- Write up - conceptual (Connecting prior research to their ideas)
- Time management
- Not sure
- Other (please specify)

* 11. How well do you think the program supports the students in carrying out and completing their research projects?

- Not at all
- Somewhat under supported
- Somewhat supported
- Extremely well supported
- Not sure

* 12. In your opinion, how important is the research project to the overall design of the program?

- Not at all important
- Somewhat important
- Important
- Extremely important
- Not sure

2. The Research Projects

* 13. Overall, how would you rate the quality of the student research projects done in previous years - on a scale from 1 to 10 (1=extremely low; 10=extremely high)?
14. In previous years, how would you rate the quality of the students' research questions (i.e., to the extent that they were informed, testable questions)?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

15. In previous years, how would you rate the students' ability to connect their own research ideas to existing research and theory?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

16. In previous years, how would you rate the rigor of the tools and methods used by the students for their research projects (i.e., were they designed in such a way that they measured what the students intended; age appropriate)?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

17. In previous years, how would you rate the quality of the students' analysis of their research data?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure
18. In previous years, how would you rate the quality of the research write up done by the students (i.e., written clearly and tells a consistent research story from beginning to end)?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

19. Do you have any other comments about the student research projects in the program?

3. Technology in the Program

20. Overall, how would you rate the ability of the students to use technology (i.e., computers, Internet, email, discussion forums)?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

21. Overall, how would you rate the comfort level of the students towards using technology (i.e., computers, Internet, email, discussion forums)?
- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure
22. Overall, how would you rate your own ability to use technology (i.e., computers, Internet, email, discussion forums)?

- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

23. Overall, how would you rate your own comfort level towards using technology (i.e., computers, Internet, email, discussion forums)?

- Extremely low
- Low
- Average
- Above average
- Extremely high
- Not sure

24. What kind of technology do you use in your own teaching in the program (select all that apply)?

- Computers (desktops, laptops)
- Handheld computers
- Word processing and reporting (e.g., Word, Excel)
- Internet
- Email
- Online discussion forums
- Online chat (e.g., MSN)
- Course management (e.g., WebCT)
- Video
- Overheads
- Powerpoint display
- CD-ROMs
- Blogs
- Wikis
- Computer games/simulations
25. How often do you use the technology mentioned in the previous question, for your own teaching in the program?

- Extremely seldom
- Seldom
- Often
- Extremely often
- I never use technology in my teaching in the program

26. Do you have any other comments about the use of technology in the program?
APPENDIX J: Transcriber Confidentiality Agreement

Date

Attn: Name
Address
Address
City, Province, Postal Code

Subject: Transcribing (6 audio files)

Offer of contract employment for transcribing of audio files - six in total. [Name] will be responsible for the transcription under the following conditions:

1. Approximately 1 transcript will be completed per week and emailed to Kim MacKinnon. Kim will send audio files to [Name] via email.

2. Rate of payment will be $25/hour. [Name] expects the transcripts to take approximately 4 hours to complete. If [Name] thinks the transcript will take longer than 4 hours, he/she will notify Kim prior to completing. Timesheet to be submitted by [Name] along with each transcript via email. Kim will write out payment via cheque and leave in her mailbox [location] to pick up. Payment will be made within one week of receiving transcript.

3. All transcripts to be completed by [date]. At this time the contract for employment will terminate, however [Name] will still abide by the confidentiality agreement below.

Confidentiality agreement:

1. All audio files and transcript files will be deleted from [Name]’s working computers once the contract is complete on [date].

2. All contents of the transcripts will be kept strictly confidential, and at no time will any details or files be shared by [Name] with anyone other than Kim MacKinnon.

Signature, Dated: Signature, Dated
APPENDIX K: Rater Training Manual

Thank you for agreeing to participate as a rater for this study. Your job as a rater will be to assign one of the following five categories (political, organizational, team, psychological, physical) to each constraint description in the verification tables (see practice coding table). Please familiarize yourself with these categories and their code numbers. You will be asked to use the code numbers when filling out the verification tables. You will have a chance to practice assigning these codes to a fictitious data set. Once your training is complete, you will be given the actual data sets (two tables) to complete on your own. After you have completed coding the data set, you will have a chance to discuss your ratings with the researcher. Any discrepancies between your ratings and the researcher’s ratings will be discussed at that time. Please feel free to make any notes in the margin of the tables that may aid discussion of your ratings later on (however, please reserve the “assign constraint category” column for assigning your codes only - to help ensure readability of the code).

Political (Code = 1)

These constraints describe factors outside the program. These might be things like: laws, rules, regulations, at the university or governmental level. These constraints would have an impact on other similar programs, not just the [program name].

Examples: Political climate, references to specific government regulations or policies, job trends, references to university-mandated policies.

Organizational (Code = 2)

These constraints describe factors inside the program. These might be things like: rules or policies at the program level, course objectives, job descriptions, program requirements. These constraints are specific to the [program name] - other similar programs may or may not have similar constraints.

Examples: References to course objectives/goals, references to job descriptions or job-related responsibilities, references to program design/objectives, references to program priorities/emphases.

Team (Code = 3)

These constraints describe personal and professional relationships within the program; how people interact with one another. These might be things like: sharing information, collaborating with colleagues, alliances among stakeholders in the program (e.g., student to student, student to faculty, faculty to faculty), methods of communication between stakeholders, agreements/disagreements among stakeholders.

Examples: exchanging information and resources between stakeholders, references to how stakeholders get along with one another, references to individuals or groups of individuals collaborating with one another or creating alliances, references to the ways stakeholders communicate with one another (e.g., email), references to disagreements or tension among stakeholders.

Psychological (Code = 4)

These constraints describe personal feelings, beliefs and/or job-related competencies among stakeholders. These might be things like: personal goals/priorities, personal values/beliefs, job-related skills or competencies held by stakeholders, job-related skills or competencies necessary for stakeholders to carry out their work.
Examples: references to personal beliefs, values, goals, priorities, references to job-related competencies or skills, reference to personal obligations, references to personal emotional states such as worried/fearful, angry, hurt, sad/upset, jealous.

Physical (Code = 5)

These constraints describe physical attributes of people, objects and/or spaces. These might be things like: where resources are located, how rooms/buildings are designed, places stakeholders tend to carry out their work, movement between places/spaces in order to carry out work, typical physical characteristics of the human body in general or particular stakeholders.

Examples: references to equipment or materials used to carry out work (e.g., what they look like, how they work, whether they function properly), references to places stakeholders tend to carry out their work, references to how equipment is distributed within and among workspaces.
APPENDIX L: Practice Coding Table

<table>
<thead>
<tr>
<th>Assign Constraint Category</th>
<th>Description of Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 1=Political</td>
<td>Students must complete six compulsory courses in order to graduate from the program.</td>
</tr>
<tr>
<td>• 2=Organizational</td>
<td>Many faculty members believe students in the program do not have sufficient technological skills.</td>
</tr>
<tr>
<td>• 3=Team</td>
<td>Graduate students are entitled to apply for Ontario scholarships to help fund their education.</td>
</tr>
<tr>
<td>• 4=Psychological</td>
<td>F1 is required to teach three full courses in the program.</td>
</tr>
<tr>
<td>• 5=Physical</td>
<td>There are two computer labs in the building where courses are held.</td>
</tr>
<tr>
<td></td>
<td>Students commented that their instructors are often unavailable to them for personal meetings.</td>
</tr>
<tr>
<td></td>
<td>Students feel the amount of tuition they pay is too high.</td>
</tr>
<tr>
<td></td>
<td>French immersion teachers are currently in high demand in the [name of school board].</td>
</tr>
<tr>
<td></td>
<td>Each month, students have a cake to celebrate the monthly birthdays of their peers in the program.</td>
</tr>
<tr>
<td></td>
<td>The elevators in the building where courses are held are often not working properly.</td>
</tr>
</tbody>
</table>
APPENDIX M: End of Year Student Survey 2006-2007

**Student Post Study Questionnaire**

**1. Questions About the Research Project**

**5. I enjoyed conducting a research project as part of my program.**

**2. Have you completed the research project?**
- [ ] Yes
- [ ] No
- [ ] My data collection is complete, and I am just finishing the written report.
- [ ] Other (please specify)

**3. How often did you discuss your research project (on average) with your faculty research advisor supervisor?**
- [ ] Monthly
- [ ] Weekly
- [ ] Daily
- [ ] Once or twice during the year
- [ ] Never
- [ ] Other (please specify)

**4. I feel I received sufficient support during the research process from my faculty research supervisor.**
- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Somewhat Disagree
- [ ] Somewhat Agree
- [ ] Agree
- [ ] Strongly Agree
- [ ] Not sure
- [ ] Other (please specify)
8. I think the research project is not given the same weight as a Master's thesis done in other education programs.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

9. I would have been willing to sacrifice one of the four practicum placements in the program in order to spend more time focusing on the research project.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

10. On a scale from 1 to 10 (1 is very poor quality; 10 is very high quality) how would you rate the overall quality of your research project?

1  2  3  4  5  6  7  8  9  10

11. Do you have any other comments about the MT research project?

---

2. Questions About the Online Research Mentorship

The following questions pertain to your experiences with the ONLINE RESEARCH MENTORSHIP. Please select the answer that best represents your stance on the following statements.
* 12. How often did you use the online mentorship resource for your research project?

- Extremely often
- Often
- Occasionally
- Infrequently
- Never
- Other (please specify)

* 13. I think the online research mentorship is a useful resource.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 14. I found the advice from my mentor to be helpful.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 15. I consider my mentor to be knowledgeable about the process of conducting research.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 16. I consider my mentor to be knowledgeable about teaching.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 17. I consider my mentor to be knowledgeable about my area of research interest.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 18. I think I shared common research interests with the members of my online research group.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 19. I would prefer to work alone on my research project.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree

* 20. I would have preferred not to have a research mentor.

- Strongly disagree
- Disagree
- Somewhat disagree
- Not sure
- Somewhat agree
- Agree
- Strongly agree
21. I would have preferred to have a research mentor, but not a research group.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

22. I would have preferred to select my own research mentor, rather than have one assigned to me.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

23. I would be more comfortable discussing my research project with my mentor in person.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

24. I would be more comfortable discussing my research project with my mentor through email.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

25. I understood that the online research mentorship was an optional resource, but I still sometimes felt pressure to participate in it.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

26. Please take a moment to explain your answer to the question above.

27. I felt comfortable sharing my ongoing research with my research mentor.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

28. I felt comfortable sharing my ongoing research with other students in my class.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Somewhat Agree</th>
<th>Not sure</th>
<th>Somewhat Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>
* 29. I would be more likely to share and discuss my ongoing research with others if I had more time to work on my research.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Not sure
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Other (please specify) ____________

* 30. I would be more comfortable working in a private online folder/view for my research project.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Not sure
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree

* 31. In general, I am comfortable sharing my ideas-in-progress with others (ideas that aren't necessarily polished or perfect).
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Not sure
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree

* 32. Which of the following statements best applies to you?
   - [ ] I am comfortable sharing my research with others once it has been completed, but I am not very comfortable sharing my research while it is still in progress.
   - [ ] In general, I am not very comfortable sharing my research with others - even once it has been completed.
   - [ ] I am comfortable sharing my research with others while it is still in progress and also once it has been completed.
   - [ ] Other (please specify) ____________
33. How did the online research mentorship help you with the overall process of your research project?

- Helping to come up with research questions
- Helping to design my research method
- Helping to narrow down and/or locate literature about my topic
- Helping with my data analysis
- Editing my written work
- Brainstorming ideas
- Emotional support/encouragement to complete my research
- Just knowing I have someone there 24-7 to go to for research assistance when I need it
- The online research mentorship did not help me with my research
- Other (please specify)

34. My primary source of support for my research was:

- My research supervisor
- Dr.
- My mentor/online research group
- Other non-faculty
- My associate teacher(s)
- Friends/peers
- Other (please specify)

35. My secondary source of support for my research project was:

- My research supervisor
- Dr.
- My mentor/online research group
- Other non-faculty
- My associate teacher(s)
- Friends/peers
- Other (please specify)
* 36. I was less likely to use the online mentorship because the mentors were not the ones ultimately marking the research.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify) 

* 37. I was less likely to use the online mentorship because I was not comfortable with the fact that everyone could see what I posted.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify) 

* 38. I was less likely to use the online mentorship because I did not feel comfortable with my research mentor.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify) 

### 3. Questions About the Weekly Online Discussions

The following questions pertain to your experience with the WEEKLY ONLINE DISCUSSIONS as part of the course. Please select the answer that best represents your stance on the following statements.

* **40.** I felt that the online discussion forum was a very welcoming and warm environment.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **41.** I felt a strong sense of being connected to my peers in the online discussion forum.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **42.** I often felt overwhelmed by the number of notes there were to read in the online discussion forum.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **43.** I often felt pressure to participate in the online discussion forum.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **44.** I felt safe exploring my ideas in the online discussion forum.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **45.** I often felt judged by others in the online discussion forum.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **46.** I felt the online discussion forum had a friendly atmosphere.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* **47.** I think the online discussion forum was easy to use.

- [ ] Strongly Agree
- [ ] Somewhat Agree
- [ ] Not sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree
* 48. I felt comfortable sharing my ideas in the online discussion forum.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 49. I enjoyed participating in the online discussion forum.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 50. I think I contributed to others' learning through the online discussion forum.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 51. I think my peers contributed to my learning through the online discussion forum.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 52. Given the chance in another course, I would like to participate in an online discussion forum again.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 53. I would be comfortable integrating an online discussion forum into my teaching.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 54. I found the email notifications to be helpful.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 55. I often visited the online discussion forum directly after, or soon after, receiving an email notification.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 56. I tended to ignore the email notifications.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

* 57. I found the course rubric for online discussion helpful in guiding my online contributions.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
58. In general, I do not feel I benefited from the weekly online discussion.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

59. I prefer to discuss my ideas with others in person.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

60. I would rather discuss my ideas through email than through the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

61. I am uncomfortable with the public nature of the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

62. What prompted you to open and read and message in the online discussion forum?

63. What prompted you to write a message in the online discussion forum?

64. What caused you to ignore a message in the online discussion forum (or perhaps open it, but not read it)?

65. Do you have any other comments about the weekly online discussion in
## Student Year End Survey 07-08

### 1. Questions About the Research Project

The following survey consists of five separate pages (note: the last page will say "6" but there's really only five). Once the survey is complete (when you click on the "Done" button), your browser will re-route to main page.

The following questions on Page 1 pertain to your experiences with the research project.

Note for Question 1: Your name is requested for the purpose of the draw, and to keep track of respondent data. Your name will not be published in any research reports/publications.

**1. Please select your name from the class list.**

**2. Have you completed the research project?**

- Yes
- No
- My data collection is complete, and I am just finishing the written report.
- Other (please specify)

**3. I carried out the majority of the work for the research project during the second year of the program.**

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

**4. When did you collect your data for the research project?**

- During the first year of the program
- During the second year of the program
- During the first and second year of the program
- Other (please specify)
5. Where did you collect your data for the research project?

- [ ] During practice
- [ ] At the university
- [ ] With participants outside a school or university setting
- [ ] Other (please specify)

6. Where did the bulk of your data come from for the research project?

- [ ] Interviews
- [ ] Questionnaires/surveys
- [ ] Observation
- [ ] Pre/Post Intervention
- [ ] Control versus Test comparison
- [ ] Numerical data
- [ ] Other (please specify)

7. Who was your research supervisor for the research project?

- [ ] Other (please specify)

8. How often did you discuss your research project (on average) with your faculty research advisor/mentor?

- [ ] Monthly
- [ ] Weekly
- [ ] Daily
- [ ] Once or twice during the year
- [ ] Never
- [ ] Other (please specify)
* 9. I feel I received sufficient support during the research process from my faculty research supervisor.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

* 10. My primary source of support for my research was:

- My research supervisor
- Other faculty
- Other non-faculty
- The online reflection journals in I
- My associate teacher(s)
- Friends/peers
- Other (please specify)

* 11. My secondary source of support for my research project was:

- My research supervisor
- Other faculty
- Other non-faculty
- The online reflection journals in I
- My associate teacher(s)
- Friends/peers
- Other (please specify)
* 12. I enjoyed conducting a research project as part of my program.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)

* 13. I felt I could have done a better job on the research project if I had more time to work on it.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)

* 14. There is so much required of students in the program that it makes it difficult to dedicate the time and energy necessary to do the research project.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)
15. I think the research project is not given the same weight as a Master's thesis done in other education programs.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

16. I would have been willing to sacrifice one of the four practicum placements in the program in order to spend more time focusing on the research project.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

17. I felt comfortable sharing my ongoing research with other students in my class.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)
18. I think I shared common research interests with some of my peers.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   Other (please specify)

19. I would have liked to have more opportunities to discuss my research with my peers.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   Other (please specify)

20. I would have liked to have more opportunities to hear about the research that my peers were doing.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   Other (please specify)
* 21. I would be more likely to share and discuss my ongoing research with others if I had more time to work on my research.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)

* 22. In general, I am comfortable sharing my ideas-in-progress with others (ideas that aren’t necessarily polished or perfect).

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)

* 23. In general, I preferred to work alone on my research.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)
24. In general, I am more comfortable discussing my research with others, in person.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)

25. In general, I am more comfortable discussing my research with others, in private.
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)

26. I would be comfortable discussing my research online, as long as it were private (e.g., private online folder, or email).
- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify)
* 27. I would be comfortable discussing my research online, as long as I could control who can read it and comment on it (i.e., choose who has access to your notes).
  - [ ] Strongly Disagree
  - [ ] Disagree
  - [ ] Somewhat Disagree
  - [ ] Not sure
  - [ ] Somewhat Agree
  - [ ] Agree
  - [ ] Strongly Agree
  - Other (please specify)

* 28. Which of the following statements best applies to you?
  - [ ] I am comfortable sharing my research with others once it has been completed, but I am not very comfortable sharing my research while it is still in progress.
  - [ ] In general, I am not very comfortable sharing my research with others - even once it has been completed.
  - [ ] I am comfortable sharing my research with others while it is still in progress and also once it has been completed.
  - [ ] Other (please specify)

* 29. On a scale from 1 to 10 (1 is very poor quality; 10 is very high quality) how would you rate the overall quality of your research project?
  - [ ] 1  
  - [ ] 2  
  - [ ] 3  
  - [ ] 4  
  - [ ] 5  
  - [ ] 6  
  - [ ] 7  
  - [ ] 8  
  - [ ] 9  
  - [ ] 10

30. Do you have any other comments about the research project?

2. Questions about the Online Reflection Journals

These questions pertain to the online reflection journals that were part of the course.

* 31. Did you elect to do the online reflection journals for the final assignment in the course?
  - [ ] Yes
  - [ ] No
  - Other (please specify)
32. How many online journal entries did you complete?
   - 0
   - 1
   - 2
   - 3
   - 4
   - 5
   - 6
   - 7
   - 8
   - more than 8
   Other (please specify)

33. I think the online reflection journals was a useful assignment.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree

34. I learned a lot through the process of reflecting in my online journals.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - I did not opt to do the online reflection journals
* 35. I found the comments posted by professor (t in response to my online journal entries to be helpful.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - I did not opt to do the online reflection journals

* 36. I found it helpful to be able to talk about my research in the online reflection journals.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - I did not opt to do the online reflection journals
   - I did not talk about my research in the online reflection journals
* 37. How did the online reflection journals help you with the overall process of your research project (you may select more than one)?

- [ ] Helping to come up with research questions
- [ ] Helping to design my research method
- [ ] Helping to narrow down and/or locate literature about my topic
- [ ] Helping with my data analysis
- [ ] Editing my written work
- [ ] Brainstorming ideas
- [ ] Emotional support/encouragement to complete my research
- [ ] Just knowing I have someone there 24-7 to go to for research assistance when I need it
- [ ] The online reflection journals did not help me with my research
- [ ] Not sure
- [ ] Other (please specify)

* 38. I liked the fact that the online reflection journals were private.

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Somewhat Disagree
- [ ] Not sure
- [ ] Somewhat Agree
- [ ] Agree
- [ ] Strongly Agree
- [ ] I did not opt to do the online reflection journals

* 39. I would have been reluctant to do the online reflection journals if they had been public (everyone in the class could read them).

- [ ] Strongly Disagree
- [ ] Disagree
- [ ] Somewhat Disagree
- [ ] Not sure
- [ ] Somewhat Agree
- [ ] Agree
- [ ] Strongly Agree
- [ ] I did not opt to do the online reflection journals
40. I would have been reluctant to discuss my research in the online reflection journals if they had been public (everyone in the class could read them).

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- I did not opt to do the online reflection journals
- I did not talk about my research in the online reflection journals

41. Do you have any other comments/suggestions regarding the online reflection journals?

42. Did you elect to copy your online reflection journal into the Student Online Research Support Centre (SORSC) - the optional research resource that you could access from the course forum? OR, did you participate in SORSC in any other way?

- Yes
- No

3. Questions About the Student Online Research Support Centre (SORSC) - Use

The following questions pertain to your experiences with the Student Online Research Support Centre (SORSC) - the optional resource that was available through the Knowledge Forum in ( ). Please select the answer that best represents your stance on the following statements.
* 43. I elected to copy my online reflection journal into SORSC so that I could receive additional comments/feedback from Kim MacKinnon and/or ( ).

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify) ____________

* 44. I found the advice/feedback I received in SORSC to be helpful.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
- Other (please specify) ____________

* 45. How did SORSC help you with the overall process of your research project (you may select more than one)?

- Helping to come up with research questions
- Helping to design my research method
- Helping to narrow down and/or locate literature about my topic
- Helping with my data analysis
- Editing my written work
- Brainstorming ideas
- Emotional support/encouragement to complete my research
- Just knowing I have someone there 24-7 to go to for research assistance when I need it
- SORSC did not help me with my research
- Other (please specify) ____________
* 46. I would have used SORSC more often, if I had more time to work on the research project.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Other (please specify)

47. Do you have any other comments about SORSC or suggestions for how it could be improved?

4. Questions About the Student Online Research Support Centre (SORSC) - Non Us...

These questions pertain to the Student Online Research Support Centre (SORSC) - the optional resource that was available through the Knowledge Forum in . Please select the answer that best represents your stance on the following statements.

* 48. I was reluctant to use SORSC because I did not really understand its purpose.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)
* 49. I would have used SORSC if I had more time to work on the research project.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)

* 50. I was reluctant to use SORSC because I felt I got the support I needed for the research project elsewhere.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)

* 51. I was reluctant to use SORSC because I was not interested in discussing my research with others.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)
52. I would have liked more support for my research, but I would have preferred it to be in person (i.e., not an online format).
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

53. I would have liked more support for my research, but I would have preferred it to be through email.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

54. Do you have any other comments about SORSC or suggestions for how it could be improved?

5. Questions About the Weekly Online Discussions

The following questions pertain to your experience with the WEEKLY ONLINE DISCUSSIONS as part of the course. Please select the answer that best represents your stance on the following statements.

55. I felt that the online discussion forum was a very welcoming and warm environment.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Not sure
   - Somewhat Agree
   - Agree
   - Strongly Agree
* 56. I felt a strong sense of being connected to my peers in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 57. I often felt overwhelmed by the number of notes there were to read in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 58. I often felt pressure to participate in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 59. I felt safe exploring my ideas in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 60. I often felt judged by others in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 61. I felt the online discussion forum had a friendly atmosphere.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 62. I think the online discussion forum was easy to use.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 63. I felt comfortable sharing my ideas in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 64. I enjoyed participating in the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 65. I think I contributed to others' learning through the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree

* 66. I think my peers contributed to my learning through the online discussion forum.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Not sure
- Somewhat Agree
- Agree
- Strongly Agree
* 67. Given the chance in another course, I would like to participate in an online discussion forum again.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 68. I would be comfortable integrating an online discussion forum into my teaching.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 69. I found the course rubric for online discussion helpful in guiding my online contributions.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 70. In general, I do not feel I benefited from the weekly online discussion.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 71. I prefer to discuss my ideas with others in person.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 72. I would rather discuss my ideas through email than through the online discussion forum.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 73. I am uncomfortable with the public nature of the online discussion forum.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Not sure</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
</table>

* 74. What prompted you to open and read a message in the online discussion forum?

[Response]

* 75. What prompted you to write a message in the online discussion forum?

[Response]

* 76. What caused you to ignore a message in the online discussion forum (or perhaps open it, but not read it)?

[Response]
6. Questions about the [ ] Program

The following questions are related to the overall program.

* 78. In the program, students are required to use technology to complete coursework, and as a program communication tool.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)

* 79. In the program, there is not a lot of time or opportunity built into the program for students to engage in independent study or carry out their research projects.
   - [ ] Strongly Disagree
   - [ ] Disagree
   - [ ] Somewhat Disagree
   - [ ] Somewhat Agree
   - [ ] Agree
   - [ ] Strongly Agree
   - [ ] Not sure
   - [ ] Other (please specify)
* 80. In the program, there is a perception among some students that the research project is not really valued in the program.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

* 81. In the program, there often seems to be a disconnect between elements of the program (e.g., between different courses), including between the research and the rest of the program.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

* 82. In the program, research skills among students in the program are varied, and often limited (i.e., they do not have a lot of prior experience with research).
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)
* 83. In the program, attempts to use technology in various elements of the program often seem like an “add on”, or extra work, and not necessarily something that adds a lot of value to our learning experience.

☐ Strongly Disagree
☐ Disagree
☐ Somewhat Disagree
☐ Somewhat Agree
☐ Agree
☐ Strongly Agree
☐ Not sure
☐ Other (please specify)  

* 84. In general, there is some value in getting comfortable with technology, and technological skills are an important competency to have as a student in the program.

☐ Strongly Disagree
☐ Disagree
☐ Somewhat Disagree
☐ Somewhat Agree
☐ Agree
☐ Strongly Agree
☐ Not sure
☐ Other (please specify)
85. Some students enter the program with a lack of experience with technology. Some students may even be a little apprehensive, or even somewhat nervous, about using technology.

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)

86. In the program, some students find it difficult to share their research with others (and in particular, in an online environment where it would be open to all their peers to read).

- Strongly Disagree
- Disagree
- Somewhat Disagree
- Somewhat Agree
- Agree
- Strongly Agree
- Not sure
- Other (please specify)
* 87. In the program, some students feel pressure to ensure that what they post online is "high quality".
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

* 88. In the program, students often have little contact with the university and their cohort peers during practicum.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

* 89. In the program, students often look to each other for support and advice.
   - Strongly Disagree
   - Disagree
   - Somewhat Disagree
   - Somewhat Agree
   - Agree
   - Strongly Agree
   - Not sure
   - Other (please specify)

90. Do you have any other comments about the program?
APPENDIX O: Pre-Survey, Mentors 2006-2007

1. Name: ____________________________

2. What is your graduate department and program? ____________________________

3. Please list two or three keywords that would describe your main research interests:
   ____________________________   ____________________________   ____________________________

4. What stages of your program have you completed?

   Coursework -      Not started _  In Progress _  Completed _
   Thesis proposal - Not started _  In Progress _  Completed _
   Data collection - Not started _  In Progress _  Completed _
   Data analysis and write up - Not started _  In Progress _  Completed _

5. Which research methodologies are you most familiar with?

   Quantitative -     Unfamiliar _  Somewhat Familiar _  Familiar _
   Qualitative -      Unfamiliar _  Somewhat Familiar _  Familiar _
   Mixed Methods -   Unfamiliar _  Somewhat Familiar _  Familiar _
   Design research - Unfamiliar _  Somewhat Familiar _  Familiar _
   Action research - Unfamiliar _  Somewhat Familiar _  Familiar _

6. Do you intend to apply for an academic faculty position when you complete your
doctorate?
   Yes _   No _   Undecided _

7. For which of the following do you have teaching experience?
   (For the following, teaching experience could be considered to be a teaching assistant or
   a full instructor)

   Kindergarten to Grade 12 - Yes _  No _
   College -                  Yes _  No _
   Undergraduate -            Yes _  No _
   Pre-service (teacher education) - Yes _  No _
   Graduate -                Yes _  No _

   Have you ever taught an online course? Yes _  No _

   Other teaching experience (please specify) ________________________________

8. Do you hold a Bachelor of Education degree or have K to 12 teacher certification?
   Yes _  No _
9. If you were to apply for an academic position today, how confident would you feel about your skills in the following?

Teaching undergraduate students -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

Teaching pre-service students -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

Teaching graduate students -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

Advising students -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

Evaluating student work -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

Conducting empirical research -
Not at all confident _ Somewhat confident _ Confident _ Very Confident _

10. Opinion Questions

<table>
<thead>
<tr>
<th>YOUR RESEARCH &amp; TEACHING</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Not Sure/Undecided</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel confident that I have the skills to do empirical research.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am confident that I would be a good academic researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am confident that I would be a good university instructor.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think my thesis research will inform my own teaching practices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think my thesis research will contribute valuable knowledge to the larger education community.</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>I think my program is/has preparing/prepared me to be a good researcher.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think my program is/has preparing/prepared me to be a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>good academic instructor/advisor.</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>I would feel more confident if I had more experience teaching and mentoring students before I assume an academic job.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think my program should do more to support the development of teaching-related skills to prepare doctoral students for academic jobs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TEACHER/ACTION RESEARCH**

| Typically, the goal of teacher/action research is primarily to inform one’s own practice. |
|I believe teacher/action research is an important element of reflective practice. |
|Teachers should be expected to engage in teacher/action research regularly as an element of reflective practice. |
|Teachers should not necessarily be expected to conduct research on a regular basis, but they should be expected to continuously keep up to date with current research and consider its potential application to practice. |
|I believe the goal of teacher/action research should primarily be to inform one’s own practice, not necessarily to inform broader theoretical perspectives or more general educational problems/issues. |
|Ideally, I believe that teacher/action research should inform broader theoretical perspectives or more general educational problems/issues, in |
It is important for teacher/action research to be shared with the broader education community (other teachers, researchers, etc).

I think teachers should participate in collaborative educational research communities on a regular basis.

Ideally, teacher/action research should be a collaborative process, involving communities of education professionals.

Ultimately, teacher/action research is a process of individual, professional self reflection.

I think technology plays a vital role in conducting research.

It would be difficult to do research without the use of technology.

I think technology plays a vital role in teaching.

It would be difficult to teach without the use of technology.

| 11. What experience do you hope to gain by participating in the research mentorship project? |
| 12. Based on your current research skills and your current teaching experience, and assuming you have already decided to apply for an academic position, **on a scale from 1 to 10 (1 is very low chance; 10 is very high chance) how likely do you think you would be to get an academic position** within one or two years of completing your dissertation? – circle one |

1 2 3 4 5 6 7 8 9 10

~ Thank you ~
APPENDIX P: End of Year Survey, Mentors 2006-2007

Mentor Post Survey

1. Mentor Post Questionnaire

* 1. Please select your name from the list.

* 2. What is your age category?

* 3. What year of study were you in as of September 2006 (when the online mentorship began)?
   - 1
   - 2
   - 3
   - 4
   - 5
   - 6
   - 7
   - 8+

* 4. Why did you decide to participate as a mentor in the online research forum ( ):

2. Ratings

Please select the option that best describes your stance on the following statements.

* 1. I enjoyed being an online mentor.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Not Sure
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

* 2. I felt I understood the needs of the students I was assigned to mentor.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Not Sure
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

* 3. I think I was an effective research mentor.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Not Sure
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree

* 4. I think I had the necessary research skills and knowledge to handle the students’ questions effectively.
   - Strongly Agree
   - Agree
   - Somewhat Agree
   - Not Sure
   - Somewhat Disagree
   - Disagree
   - Strongly Disagree
* 15. I would have preferred to advise my students about their research in private (one-on-one).

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 16. I would have preferred to have some training on how to advise students prior to assuming my role as a mentor.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 17. I think some of the students would have preferred to discuss their research in private (one-on-one).

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 18. I had at least one student from the mentorship contact me through my private email.

- [ ] Yes
- [ ] No

If yes, how many?

* 19. I was often left wondering whether my advice was of any use to my students.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 20. I expected students to participate in the online mentorship more often than they actually did.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 21. I often got the sense that my students did not like my advice.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 22. I think the quality of the student research projects were comparable to other Master’s theses I’ve seen.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree

* 23. Participating as a research mentor took up too much of my time.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Somewhat Agree
- [ ] Not Sure
- [ ] Somewhat Disagree
- [ ] Disagree
- [ ] Strongly Disagree
24. I often went into other online research views in the forum to get a sense of how other mentors were advising their students.

25. I would have liked to have regular meetings with the other mentors to discuss our ideas about how to support the student research.

26. I would participate as an online research mentor again.

27. I would participate as a research mentor again, even if it were face-to-face and not online.

28. I think the online research mentorship was a good learning experience for me.

29. I learned a lot about advising students by participating as a research mentor.

30. I learned a lot about teaching by participating as a research mentor.

31. I think my experience as a research mentor will help me get an academic job in future, should I decide to apply for one.

32. I think all doctoral students planning to have an academic career, should have the opportunity to gain teaching experience as part of their program.

33. I think all doctoral students planning to have an academic career, should have the opportunity to gain research advising experience as part of their program.
3. Background

* 1. Have there been opportunities for you to gain post-secondary teaching experience as part of your doctoral program (other than the online research mentorship)?
   - Yes
   - No
   - Not Sure

* 2. Have there been opportunities for you to gain experience as a research adviser as part of your doctoral program (other than the online research mentorship)?
   - Yes
   - No
   - Not Sure

* 3. Had you ever taught a post secondary course, or been a teaching assistant for a post secondary course, prior to participating as a research mentor?
   - Yes
   - No
   - Not Sure

* 4. Had you ever been a research adviser prior to participating as a research mentor?
   - Yes
   - No
   - Not Sure

* 5. If you were offered an opportunity to teach a course in your area of expertise during your doctoral program, would you?
   - Yes
   - No
   - Not Sure

Why, or why not? 

[Blank space]
* 6. If you were offered an opportunity to be a teaching assistant in your area of expertise during your doctoral program, would you?
   - Yes
   - No
   - Not Sure
   Why, or why not?

* 7. If you were offered an opportunity to be a research adviser for Undergraduate and/or Master’s students during your doctoral program, would you?
   - Yes
   - No
   - Not Sure
   Why, or why not?

4. Short Answer Questions

* 1. How would you describe the student research projects for which you were a mentor (e.g., in terms of quality, range of topics, current relevance in the field)?

* 2. How would you describe the student research projects for which you were a mentor, in comparison to other Master’s research you have seen/read about?

* 3. How do you think the students may have benefited from the online research forum?

* 4. Why do you think some students chose not to participate in the online research forum?

* 5. How do you think the online research forum could have been better designed to support the students’ research?
6. How did you benefit from participating as a mentor in the online research forum?

7. How could your experience participating as a mentor in the online research forum have been better?
## APPENDIX Q: Constraints Addressed in Innovation 1 of the Design Study

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<th>Category</th>
<th>Description of constraint</th>
<th>Description of implications and design strategies</th>
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<tr>
<td><strong>Organizational Constraints</strong> (Program priorities and expectations, course expectations, admission criteria, scheduling, job descriptions, incentives/disincentives)</td>
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| 1              | According to F2, there is an expectation that the students will complete their data collection during their first teaching placement in the second year of the program. | Implication(s): The bulk of data collection may occur by October/November, in the practicum location.  
*Design Strategy:* Research supports were put in place from the beginning of the year. |
| 2              | According to F2, although many of the faculty that teach the Year 2’s have elements of research in their courses, there’s not officially “a research course” during the second year of the program. | Implication(s): Students carry out their research independently, outside of coursework.  
*Design Strategy:* Research support was connected to the Psychology course since it is not formally connected to any other course in the program.  
Course-specific strategies connected to (made sense with) concepts covered in the course (e.g., social constructivism).  
Design built upon strategies already used by the course instructor to support the students’ research from within her course. |
| 3              | According to F4, exploring the use of technology in teaching is one of the major components of the MT program. | Implication(s): Use of technology in teaching is a program priority.  
*Design Strategy:* The research supports were |


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<td>housed within an online discussion forum called Knowledge Forum®.</td>
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<tr>
<td>4 Organizational</td>
<td>According to F5, students are expected to conduct the literature review, data collection and write-up for their research projects during the second year of the program.</td>
<td><em>Implication(s):</em> The bulk of the research project is likely to be carried out during the second year of the MA-T program.</td>
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<td><em>Design Strategy:</em> The research support targeted second year students.</td>
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<td>5 Organizational</td>
<td>Students are required to use technology to complete coursework, and as a program communication tool.</td>
<td><em>Implication(s):</em> Second year students will have some experience with technology for completing coursework and as a communication tool.</td>
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<td><em>Design Strategy:</em> Knowledge Forum® is used as a discussion tool to support work related to the research project (which also connected to work in the Psychology course).</td>
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<tr>
<td>6 Organizational</td>
<td>There is not a lot of time or opportunity built into the program for students to engage in independent study or carry out their research projects.</td>
<td><em>Implication(s):</em> Students need to fit the research project around other program priorities.</td>
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<td><em>Design Strategy:</em> An online research mentorship was designed - using Knowledge Forum® - so students can communicate with their peers and access help from doctoral research mentors, at any time (as they need it).</td>
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**Team Constraints** *(How groups of people work together to make decisions and carry*
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| 7 Team   | F2 mentions that there was a lack of consensus among faculty, regarding who would be supervising students, and whether formal supervision was actually needed. | Implication(s): Some students may not have immediate access to a supervisor, or until their research is already in progress.  
Design Strategy: Students have immediate access to the mentors through Knowledge Forum®. |
| 8 Team   | According to F2, the amount of help students need with the research varies during the year, and also between students, but there are times when there will be a flurry of contact with students, when they feel uncertain about details of their research, or when they are under the pressure of time to complete the research. | Implication(s): The need for research support among students may vary at different times throughout the year.  
Design Strategy: Email notifications are sent to mentors and students when there is new activity (new notes posted) in the online mentorship. |
| 9 Team   | Students often have little contact with the university and their cohort peers during practicum. | Implication(s): Students have little contact with their peers and the university at a time when many are collecting research data.  
Design Strategy: Students can access their peers, and the mentors at any time, through the online mentorship; including during practicum. |
| 10 Team  | Students often look to each other for support and advice. | Implication(s): There is likely an existing network of peer support in the program.  
Design Strategy: Small |
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<td>research groups of 3 to 5 students were established. Students could read and respond to each other’s notes related to the research. Knowledge Forum® has an open design which allows students to access and respond to notes posted by students both inside and outside their research group.</td>
</tr>
<tr>
<td>11 Team</td>
<td>According to F2, the associate (partner) schools do not always support the students in carrying out their research, despite the fact that they’ve agreed to do this as part of their role.</td>
<td>Implication(s): Students may not receive sufficient support for carrying out their research in their practicum settings (where many collect their data). Design Strategy: Students are encouraged to access research supports during practicum that are available through the online mentorship.</td>
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<td><strong>Psychological Constraints</strong> (Personal competencies, understanding, priorities, skills, feelings)</td>
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<tr>
<td>12</td>
<td>Psychological</td>
<td>Implication(s): Program integration is a priority for F1. She has already made links to her Psychology course with students’ research projects. Design Strategy: Pedagogical strategies in the course context are linked to broader program requirements. The online research mentorship is visibly linked to the Psychology online forum also Knowledge Forum®.</td>
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<td>One of F1’s personal priorities for her teaching is to make sure that her assignments and the major ideas she covers are integrated with other aspects of the program.</td>
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| Psychological| F1 believes that learning happens by interacting with others, and through discussion.     | Implication(s): Collaboration is a priority for F1.\  
Design Strategy: The online research mentorship is designed to support student collaboration around the research projects - with peers and doctoral research mentors.\  
Course strategy - weekly online discussion is a priority in the context of the Psychology course. |
| 13           |                                                                                          |                                                   |
| Psychological| F1 believes it is important to have other graduate students involved in the MT program. She thinks both the graduate students and the MT students benefit from learning from each other. | Implication(s): Possibility to link other graduate students to support research.\  
Design Strategy: Six doctoral students were invited to participate as mentors in the online research forum (one of the mentors is also the researcher). |
| 14           |                                                                                          |                                                   |
| Psychological| F2 claims that some students are better able to carry out the research projects than others. | Implication(s): There may be variability of research competencies among students.\  
Design Strategy: The online mentorship is designed to give students ongoing support through their peers and the graduate mentors, for carrying out their research projects. |
<p>| 15           |                                                                                          |                                                   |
| Psychological| According to F5, the MT                                                                  | Implication(s): Students may                     |
| 16           |                                                                                          |                                                   |</p>
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<td>students are often working on their research right up until the end of the year - just before marks are due for faculty.</td>
<td>need help to balance work involving the research throughout the year, around other priorities.</td>
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<td><em>Design Strategy</em>: Course-based strategy - students are given an assignment in the Psychology course that links learning principles to their research. Students submit a short summary of each component of their research (something they are expected to do anyway in the program) at various times throughout the year.</td>
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<td>The online mentorship is designed to provide regular and immediate feedback and assistance to students throughout the year.</td>
</tr>
<tr>
<td>17 Psychological</td>
<td>According to F5, some faculty find it challenging to deal with the demands of a combination, pre-service and graduate program (e.g., practicum supervision and research support).</td>
<td><em>Implication(s)</em>: Some faculty may need help to manage some of the demands around research supervision.</td>
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<td><em>Design Strategy</em>: Access to the online mentors and peers provides opportunity for students to seek help and feedback from multiple sources, rather than reliance on supervisor alone.</td>
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<tr>
<td>18 Psychological</td>
<td>F6 doesn’t believe students are always well supported (e.g., given access to quality teaching, access to supervisors).</td>
<td><em>Implication(s)</em>: The quality of research supervision may vary; some students may need more support.</td>
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<td><em>Design Strategy</em>: Access to the online mentors and peers provides an opportunity for students to get help in ways they may not be getting through their supervisor alone.</td>
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<td></td>
<td>provides an opportunity for students to get help in ways they may not be getting through their supervisor alone.</td>
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<tr>
<td>19 Psychological</td>
<td>There is a perception among some students that the research project is not really valued in the program.</td>
<td>Implication(s): The student research needs to be recognized and acknowledged within the program (and perhaps outside the program). Design Strategy: Course-based strategy - to have an end of year research conference in which students present their research to peers, the mentor and faculty. Doctoral mentors and other faculty are invited to the conference.</td>
</tr>
<tr>
<td>20 Psychological</td>
<td>Students perceive a disconnect between elements of the program (e.g., between different courses), including between the research and the rest of the program.</td>
<td>Implication(s): The student research needs to be connected to other aspects of the program. Design Strategy: Pedagogical strategies in the context of the Psychology course are linked to broader program objectives around the research projects.</td>
</tr>
<tr>
<td>21 Psychological</td>
<td>Research skills among students in the program are varied, and often limited.</td>
<td>Implication(s): Some students may need more support than others to carry out the research project. Students may be lacking basic research knowledge and skills.</td>
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<td><em>Design Strategy:</em> Doctoral mentors (trained in education-based research) is available through the online mentorship to answer questions, provide feedback and encourage ongoing discussion around the research.</td>
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<td>Each mentor is responsible for facilitating one small online research group (containing 3 to 5 students).</td>
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<td></td>
<td>Research groups are established based on common research interests among students (and mentors).</td>
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<tr>
<td>22 Psychological</td>
<td>Attempts to infuse technology in various elements of the program have been seen by students as an “add on”, or extra work, and not necessarily something that added a lot of value in their learning experience.</td>
<td><em>Implication(s):</em> Technology should support work that students are already doing.</td>
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<td><em>Design Strategy:</em> The online mentorship is designed to support the student research (a major component of the program); it is not just about students learning how to use technology.</td>
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<td>Course-based strategy - students can access the online mentorship directly from their Psychology discussion forum; they do not need to access a separate online program.</td>
</tr>
<tr>
<td>23 Psychological</td>
<td>Students perceive that there is some value in getting</td>
<td><em>Implication(s):</em> Opportunities to learn to work with new technology.</td>
</tr>
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<td>Category</td>
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| 311          | comfortable with technology, and that technological skills are an important competency to have for the program. | technology is valued among some students.  
*Design Strategy:* Knowledge Forum® is a new technology for students in the program - they do not use it in other courses (outside the Psychology course and the online mentorship). |
| 24 Psychological | Some students enter the program with a lack of experience with technology and/or techno-phobic tendencies. There is some resistance among students to using technology. | *Implication(s):* Technology competencies may vary among students. Some students may need extra technological support.  
*Design Strategy:* Class time in the first few Psychology classes is devoted to learning how to use Knowledge Forum®. The online mentorship is also introduced at this time, since it can be accessed from the Psychology forum.  
Students are offered extra support from the researcher, upon request. |
APPENDIX R: Examples of Student Notes from the ORM

Identifying a research problem

Identifying a research problem was one of the most common topics discussed between students and mentors. The following are examples of students and mentors discussing the task of identifying a research problem, in the ORM.

Yelena (mentor) and Andrea:

Comments on Andrea’s First Draft by Yelena [2006, Oct 13]

Hi Andrea,

I’ve had a chance to read through your draft lit. review and to begin, I think you have an excellent first draft. You are quite clear in defining extrinsic and intrinsic motivation as it pertains to the field and this will provide the foundation for your literature review and your study. You have noted “what is extrinsic and intrinsic motivation?” as part of your research questions, but I think you really mean this to be addressed in your lit. review (as you have), so I don’t think you need to list it as a research question.

I am still a little concerned about the scope of your questions, but this might be because I don’t know how you plan to research your questions. I think you will be able to address many or all of the research questions you have outlined if you are envisioning your research to be comprised mainly of interviewing and/or observing practicing teachers. However, if you are intending to perform an intervention (test out some intrinsic techniques), then you might want to address a question with a smaller scope (given the amount of time you have to do the research). This might be something like getting the students working in a cooperative learning-type situation and observing their interactions, behaviours, and comments, etc.

I would like suggest that you consider re-wording the statement: “My goal is to help students become ‘self-directed learners’ who have good values”…I think the self-directed learners part is very valuable and links well to the intrinsic motivation topic, but the “good values” part is itself value-laden…(it might lead one to question: who’s values? values about what? what do you mean by “good”?) You may have been intending to do this anyway…I wasn’t sure if the question marks meant a missing citation or that you wanted to reword this statement.

I don’t know whether you have been given any specific guidelines about how to organize your literature review, and I think yours is overall very well structured. I would like to suggest you consider the following thoughts however…

- As you have done, start with a statement of the problem…in your case you have
noted what you have observed and you have supported this with literature about extrinsic motivation systems.
- This leads to your introduction to the issues you will be addressing in the literature summary/review part of your paper (…evidence suggests extrinsic motivation doesn’t work, but intrinsic motivation does, and here are some ways the research suggests that teachers can foster this…).
- At this point you can note where you see “gaps” in the literature or where you think further investigation is warranted (…you suggested “practical” studies…) and then outline your overall research question(s). This should be a fairly general statement that summarizes what will be your specific questions later…“I will be investigating the language teachers use and the strategies they employ, like cooperative learning and classroom management techniques, to intrinsically motivate students…”
- Next comes your literature review section…as you have organized it…
- Summarize what conclusions that you draw from the research (which should be similar to what you postulated in the beginning).
- Outline your specific research questions which should follow directly from what you are writing in the summary.

If you have any specific questions about your review…or about what I have mentioned again about the scope of your questions, please let me know.

Yelena

Response to Yelena's comments by Andrea [2006, Oct 14]

Thank you for reading my literature review and for your feedback. You're right about "what is extrinsic and intrinsic motivation?" not being a research question and so I'll remove it from that section and just keep it in the lit. review.

"I think you will be able to address many or all of the research questions you have outlined if you are envisioning your research to be comprised mainly of interviewing and/or observing practicing teachers." - THIS IS EXACTLY WHAT I'M PLANNING ON DOING AND ORIGINALLY THIS IS ALL THAT I WAS GOING TO DO. HOWEVER, I THINK I MIGHT PERFORM A MINI-INTERVENTION IN TERMS OF THE LANGUAGE AREA. FOR EXAMPLE, WHEN STUDENTS ASK, "DO YOU LIKE THIS?" I MIGHT SAY, "IT SOUNDS LIKE YOU REALLY LIKE IT." AND ENCOURAGE THEM TO THINK ON THEIR OWN RATHER THAN JUST TELL THEM WHAT I THINK TO SEE WHERE THIS LEADS. (don't mean to yell with these block letters, just wanted to separate this part of the text)

I understand what you mean about me writing that I want students to have "good values." I might cut the character education stuff out of my paper or put it in briefly. What I'm trying to get at is...I don't agree with the whole char. ed. stuff that promotes respect month or politeness month, etc., but I do think that these values (maybe they're not values?) need to be taught throughout the curriculum, and I this was what I was going to try and get at in my paper. So, students in my class will be learning about respect, etc., without me preaching these values to them. Hmmmm, maybe I could reword it as positive characteristics...nope, not good, I'll come up with something.
Yes, thank you, your suggestions are helpful and we have all been given a general outline of how to structure our paper in terms of the sections.

Again, thank you very much for your feedback and I look forward to continuing our discussions.

Andrea

One of the longest threads in the ORM occurred in Mark’s online research group (with one of his students Darren) with respect to identifying a research problem. The exchanges began with the first, scaffolded note - posted in September - that each of the students was requested to post by the researcher (to provide the mentors with some initial information about the students’ topics), and it continued into February of the following semester. The notes suggest that Darren spent much of the first semester of the year working out his topic.

Darren's Research Plan(s) by Darren [2006, Sep 25]

1. Do you have any prior experience with carrying out a research study? Please specify.

Yes. I have held two GA [graduate assistant] positions in which I have had an opportunity to develop research skills. My requirements included investigating a wide range of research topics, creating literature reviews, and writing toward publication. If anyone is interested in finding out the kinds of topics I have researched please let me know.

2. What area of interest are you planning to investigate as part of your [MA-T] research project?
Currently I am looking at two areas of study:
1) Teaching for wisdom and Matthew Lipman's "Philosophy For Children"
2) American Sign Language and the Ontario Curriculum

3. Do you have specific research questions in mind yet? Please specify.
1) How could students benefit from learning critical thinking skills (such as those used to develop ideas in philosophy) at a very young age? Would this help students make more connections across the curriculum?
2) How could American Sign Language be used to help teachers more effectively deliver parts of the Ontario Curriculum.

4. What do you think are the benefits and drawbacks to doing teacher research (action research)?

The benefits are likely in the experience and knowledge gained that could be translated back into the researcher's own teaching. Provided that the research is grounded in a sincere interest in observing, and not in finding a particular answer at any cost, there is also a wider implication that a teacher researcher may discover something new to improve the lives for teachers and students.

A key drawback is the zoo effect that is a byproduct of intense observation. Young students generally won't understand the scope of why they are being observed and are subject to conclusions that may or may not be valid, especially given the varying degree of qualifications that teacher researchers possess.

5. Is there anything specific that you think you will need help with over the coming year to help you with carrying out your research project?
   - discussing literature perspectives
   - editing
   - integrating qualitative data

[Boundaries and Qualitative Integration by Mark [2006, Sep 22]]

Darren -

It sounds like you have arrived at this point a bit farther along, both in research abilities/experience and writing, than most of your peers. I think establishing the boundaries of the research and this desire to integrate the qualitative are the most important issues right now.

The first thing that I am trying to reconcile is the relevancy of the use of ASL to developing "critical thinking skills." In your short description, the connection is not there. Why ASL as opposed to, say, another "foreign" language? What are the relative affordances?

This notion of "effectively deliver" is also a bit vague - how are you going to measure to what degree this delivery is "effective." Is this in the mind of the teacher? The connections the students are making?

Subject selection is going to be another issue because you are talking about cross-curricular implications - how are you going to investigate that? Which cross-curricular subjects would you select to incorporate?

There seems to be an initial endorsement of Lipman's definition of "critical thinking skills" (which is a debated phrase itself) - why this definition and his belief of philosophical incorporation into schools in grades lower than students typically study philosophy?
I just see so many different aspects of this study - ASL, philosophy for children, critical thinking, cross-curricular impact, efficacy - and I don't see the relevancy across all of them. At least for the rather small scope of this research project.

The incorporation of the qualitative is also something I am not sure about. You want to include qualitative data, but what sort? In what area? Which methodology do you expect to use?

Because of your strong experience in the research and technical aspects of research, I think you're toughest challenge is going to be narrowing your research focus. There is a great deal here but the connections are vague and the question has to be more well defined so that the methods and subjects and reason for study are clearest to you.

Mark

Re: Boundaries and Qualitative Integration by Darren [2006, Sep 25]

I think your comments are bang on and I certainly feel my focus is scattered at best this year. Truthfully I am not even sure of my topic area yet and whether or not I will go with either.

In terms of the Lipman stuff what would really interest me would be to spend a whole year using the Philosophy for Children program and see how, if at all, it improves learning across the curriculum. In other words do these so called critical thinking skills provide students with tools for thinking that can be used regardless of the subject matter.

In terms of ASL, my goal was really more selfish than anything else. I really just wanted an opportunity to work with deaf populations because I am loving sign language right now and want as many opportunities to practice as possible.

With that said…

I feel I have a lot of interests but no big question to ask yet. With such a tiny project I feel as though we aren't in a great position to say very much anyway. I will consider your questions this week as I am feeling very under the gun to make a decision whether I am ready to or not.

Early Identification by Mark [2006, Oct 01]

Hey Darren!

Thanks for the feedback. I am glad that you saw the splits in interest that I identified. The two might be relatable, but as I pointed out, this research project is on a much smaller scale, so you might have to make some choices and eliminations you otherwise would not want to.
It seems that right now you need to make a choice between working with the Lipman stuff and the Philosophy for Children and working with deaf populations.

From what you’ve written your passion is greater for the latter, but would you have access to deaf students or even hearing students where you can implement some changes?

If it becomes a matter of subject/context, that might make the decision for you.

New area of study but at least I am sure by Darren [2006, Oct 02]

Okay Mark,

So I have decided on a third area for my research. It will fall within the wider study of Critical Literacy and will specifically deal with Media Literacy in the Ontario Curriculum.

I have been developing a number of questions that could help me develop a research path. Generally speaking, I want to interview a few teachers who feel that they can successfully teach the new Media Literacy strand in the Ontario Curriculum's Languages document. I would like to explore how they think Media Literacy and Critical Literacy are connected, and ask them to give some concrete examples of instructional strategies they would or have already implemented within their classrooms.

I would also like to get their perspective on whether or not they think anything important has been left out of the curriculum that would help other (potentially less trained) teachers from successfully delivering meaningful content to their students.

What do you think of this as a starting point?

Research Questions/Notes by Darren [2006, Oct 03]

Hey Mark,

Here are some more specific questions and notes that I have developed for this project. Let me know what you think when you have a minute.

Cheers,

darren

Where do attachments show up? Research Questions/notes

Still need to focus by Mark. [2006, Oct 08]
Hey Darren -

It's surprising how people arrive at their interests, isn't it? You've settled on something it seems. And it's a very encouraging start on a very important subject within the scope of education.

People tend to treat critical literacy with too superficial an approach but it's very hard work.

The notes you have come up with are encouraging for a couple of reasons. First, it shows your interest and commitment to this issue. Secondly, it shows that you have given it considerable thought.

There are still some questions I have though.

You say that you want to explore how teachers feel they can be successful in your note and you don't really go into it in the word document.

The notion of "success" is problematic when there is no further delineation of what that means. I'd stay away from trying to ascertain the "success" of instructional strategies. There's so much else here that I think has more potential for a research paper of this scope that isn't going to drag you down in trying to measure success or efficiency of instructional delivery.

You have three perspectives in your first question. I think that you need to decide how you are going to manage these and if you can accomplish an adequate representation of all three.

I think you need to lose or focus solely on the student perspective. It's broad and compelling and something I think needs to be investigated. But student contact, context, and study is probably more than this research project allows for, in time and space and legality. By what standard would you judge students who "lack" skills? How can that be measured? Is it the student? Is it campus based? Is it language proficiency? I just don't think you have the time needed to do a good job addressing the students.

The other two, I think, have a great deal more promise with the time and resources you have available.

You are not going to be contacting the ministry, presumably. And I don't think that you need to concern yourself with what the Ministry thinks. They have produced a document - take that for their input. Perhaps a starting point for your research and literature review and introduction.

I think the focus should be on the teacher. But you still focus on the measurement aspect of things. Look at your language: "how will learning improve" and "How will this enrich" or "how will success be measured" - those are really tough things to measure if your interest is in teacher opinion. Be wary of trying to have your cake and eat it too.

I also think that the questions of the parents and the university faculty are not
really the most appropriate for what you seem to be interested in.

Most of your notes are teacher centered. What that tells me is that your focus is on the teacher - so stick with that. You have lots of good questions that we can work with/on if this is indeed the direction you want to take.

You've decided on which area you'd like to research. Now it's a matter of context - whose perspective are you most interested in?

Ministry?
Students?
Parents?
Teachers?
Professors?

You cannot do them all and do a thorough job.

So there's no real use addressing further specifics until you decide on which you'd like to focus from here on out.

SO far, though, it's a great, encouraging start!

Mark

Research so far by Darren [2007, Jan 08]

Hey Mark,

Sorry for not replying earlier to your suggestions, however, they were useful to me toward narrowing the scope of my research.

Attached you will find my current research(lit review+main argument) in which I begin to form the way that I would like to address some the issues around media literacy discussed earlier.

I have decided to make teachers my focus (a while ago actually) and my next step will to be create a set of questions that I will ask sometime within the next month and a half. Any suggestions that come to mind from looking at my paper would be well appreciated.

Cheers,
darren

media literacy paper

Thx Darren by Mark [2007, Jan 10]
Hey Darren -

I am just glad to know and heartened to hear that someone is actually listening lol [“laughing out loud”]. Of course, I imagine that this semester will see a bit more activity than last, where the work was primarily abstract (ie in your heads), as opposed to something concrete like this document.

I've downloaded it, but am booked with work and research the rest of this week. I'll put it in the reading queue and should be able to take a look at it early to middle of next week and get a response to you during that time.

Will that work?

research paper by Darren. [2007, Jan 10]

sounds great - looking forward to hearing what you think.

darren

sorry for the delay by Mark [2007, Feb 20]

Hey Darren -

Sorry for the late response. I read your piece weeks ago now and typed up my response and shortly thereafter, I spilled orange juice on my laptop and just got the replacement keyboard - a rather protracted ordeal since I got this laptop in the states.

Anyway, I'll go ahead and paste my thoughts on the paper below here.

I hope that it doesn't sound overly negative or critical. But I wanted to try and point out some areas that might catch you up later on. Overall, I think the context - historical and curricular - should be a single part rather than two different parts of the paper. Also, the theoretical background on handling media is somewhat lacking. You might try expanding the philosophy on media criticism and critical literacy slightly outside of the strictly educational since much of the media criticism is too reliant on educational initiatives - it's as if there's little questioning of where these expectations come from. It starts outside education and is a wider humanities/sociological issue. So, expansion of that particular horizon in the way of theory and philosophy might help situate the argument a bit better.

More detailed thoughts/references to the paper below:

There remains a lack of cohesion – the relevance of the historical is questionable at best, without further explanation and examination. The use of the word media and its associated ‘mediated’ events is rather haphazard and a bit too loose and presumptive. Is the 1968 document traditional or progressive? There is an
inherent contradiction in the paper when you contrast it to the Harris-led provincial government. The theoretical base is a bit weak – you beg the philosophical question once you use the word “gaze” and I am not sure how relevant the example is. It begins to become a bit clearer, but the path is a bit too long and wayward as you arrive to what ends up being a provocative point - you need to get to the point quicker - there is a lot of wasted space here that can be better used in other parts of the paper. The multimodality discussion and the example of the teacher trying to get the class quiet is also a bit cumbersome and in the end, I am not sure that what you are describing as multimodality is actually the multimodality that the literature speaks to. Perhaps the example is apt, but the terminology is off - not sure what the case is. I understand that you are trying to introduce teaching as a mediated act and, as such, should be held under the same analytical scrutiny as the media being analyzed in the lesson. The focus on the documents, as texts, is enlightening – perhaps the historical and document-critical can be combined and expanded to serve as a more coherent base from which you can delve into the event of the classroom. Be careful of talking about “structural flaws” in instruction/curriculum – that complicates the open nature of analysis for which you seem to be arguing. You do it in another spot where it seems you argue, albeit indirectly, for a strictly dichotomous teaching atmosphere: constructivism vs. direct teaching. You are having to walk a line that can be tough to negotiate - how to be critical of what you witness in someone else's teaching or your own and not assuming a lecturing tone, as if you are telling them what they should be doing and how they should be doing it.

The issue you are tackling is a really, really admirable one. And, of course, I am probably biased since this work tends toward precisely the work I have been doing - but I really think in this day and time that really deconstructing the media curriculum and the media used in the classroom and the event of teaching as media also need deconstructing.

The paper needs some tightening up, I think, especially at the beginning by combining the first couple of parts. Then I think your paper lacks a discussion of any theoretical/philosophical treatment of media analysis. In this era of qualitative theory and methods/methodologies, there needs to be more of a philosophical discussion to ground/legitimate the urgency of media deconstructing/analysis.

You are off to a really strong start and off to a compelling paper. The sources you used and even much of the purpose of the paper and the format resembles my Masters thesis where I looked at the alarming discrepancy between the literary canon of possibility and the literary canon of practice. I was heartened to see you championing the same cause with many of the same references I used.

I hope that this helps a bit and I apologize for the relative tardiness of the response.

Best of luck and let me know if there's anything else you think I can contribute or help with.

-Mark
I might not have made the following point clear enough in my post above -

you might be wondering or asking yourself - 'why should I bother putting non-
educational philosophy points in an educational paper?' and here's my answer to that:

it is really, really tough to argue a point by working within the confines of a pre-
existing argument. To stay within the admittedly narrow definitions of media and
media literacy as set by the Board of This or Ministry of That really limits the
scope of the paper. By addressing, through expansion, broader sociocultural
aspects of media and the importance of media, you are able to present an
altogether new perspective and perhaps introduce a bit of an innovative approach
in what you are criticising in the first place.

If you accept only the tenets set forth by the board or their documents, then you
are arguing on terms already set. You seem to want to question that approach and
to do so, I think logically, lies from without - decentering the normalized from
without as well as within.

**Reviewing the Literature**

After seeing that many of her students needed help with finding literature on their
research topics, Monica posted this general note to her group:

Hello all;

Some of you have mentioned that you might need help locating scholarly
material for your research project. Reviewing the existing literature in your area
is an important part of any research project. Besides informing you about the
research done on your topic, becoming familiar with the literature will help you
situate your own topic in a broader context.

[Names university]'s electronic database is huge. Access to a tremendous amount
of relevant information is literally at our fingertips, if we can just find the
information that we're looking for!

One thing that I’ve done on more than one occasion is to take one of the Finding
Journal Articles workshops at [names a campus library]. It’s free to all [names
university] students, and it’s not a huge investment in time (it’s just over an hour
long). The great thing about these workshops is that they can save you tons of
time when conducting research in your own area. They go over relevant databases for your needs, how to construct ideal key word searches so you find what you’re looking for, and how to email the articles to yourself. You leave with some useful handouts that you can refer to after you’ve forgotten most of what they said (I’m speaking for myself here).

I know you’re all busy with course work and other commitments, but if you can squeeze the workshop into your schedule, it will make the research process that much easier.

Cheers,
Monica

Like most of the other mentors, Monica gave individual students references to particular journal publications that could inform their research. In addition, she also used the “attachment” function in Knowledge Forum® to share particular documents she had found.

**Specifying a Purpose for the Research**

Specifying a purpose for the research, and narrowing the purpose into specific research questions was one of the most common discussions that occurred in the ORM (next to identifying a problem). The following is an excerpt from Elaine’s research group.

[Clarifying Concepts by Elaine [2006, Sep 19]

Hi Erin,

What a rich area of research you’re interested in. It seems to me like you have a number of worthwhile research questions possible.

You’ve made a great start in refining your research question. You mention motivation to participate, social interactions and class performance. An issue that you should consider carefully as you move forward is how you might relate play in unstructured games to motivation, social interaction and class performance. A key issue within research is validity, that is, ensuring that you are measuring what you say you are measuring. Therefore, as you further clarify the concepts you’re working with you can turn to other studies of those concepts to see what measures other researchers have used to identify changes in social interaction, motivation to participate and class performance. You might also decide to look at only one or two concepts (e.g., just motivation to participate or social interaction or classroom performance).
Elaine

My new research question by Erin [2006, Oct 19]

Hi Elaine,
I'm sorry it has taken me a long time to get back to you. I've been busy trying to narrow down my focus a little bit.

I have done quite a bit of research on play, and the benefits of play and things like that. I have recently reformatted my research question to look something like this:

What are teachers perceptions of play as a component of classroom instruction/teaching strategies at the primary level?

I am planning on surveying teachers in my school and maybe upon recieving their results choosing to interview 2 teachers to get additional information.

I have started my literature review however now that I have changed my question I need to find some more articles on how play is used in the classroom and things like that.

Let me know what you think!
Thanks,
Erin

Re: new research question by Elaine [2006, Oct 19]

Hi Erin,

You are still in the same general area of your original topic which is great. That indicates a strong interest in your topic area. The process of formulating a research question and reading the literature is a process that feeds one into the other, so it looks like your on the right track.

In research there is often a primary question and then sub-questions that guide data collection and analysis. You might think about some sub-questions that describe further what it is about teachers perceptions of play that interests you. For example:

- How do the teachers (perhaps the 2 you interview) include play in their classroom instruction/teaching? You could use observation here supplemented by an interview.
- Do teachers perceptions of play affect the types and amount of play they integrate into their classroom instruction? Since you’ve done reading in the area of the benefit of play, you might be able to relate teacher’s perceptions toward play and the way that it occurs in their classrooms.
- What kinds of play and how much play do teachers include in their classroom
instruction? This could be collected using the survey.

In this way you can begin to look not just at teachers perceptions of play but also how these perceptions affect their use of play in their classrooms. If you think is beyond the scope of your study, then feel free to ignore it.

As you start to work through your literature review the research you can think some more about what sub-questions you want to investigate further. Feel free to post your literature review, in any form when you want feedback,

Elaine

Later in October, and into November, Elaine and Erin continued their conversation by discussing the format of Erin’s questionnaire for her teacher participants (see next section), in light of her new research question. Then, Erin contacted Elaine again in February to ask her for feedback on how to write her Method section for her research report.

**Collecting Data**

The following is the continuation of Elaine and Erin’s conversation, which had started earlier (see above) around specifying a topic for the research.

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Hey Elaine,
Thanks so much for your feedback. I will really consider the ideas you offered me!
I have drafted a survey that I will be handing out to the teachers at my school. I was wondering if you would be able to take a look at it. I'm just looking for some feedback to see if I overlooked anything extremely important, and/or whether the format of my survey is confusing. I will include in the letter of permission that will go along with each survey, a definition of the terms 'play' and 'unstructured' play so the teachers know what I mean by each question.
Let me know what you think!
Thanks so much! Erin's Research Questionarie
Erin
Hi Erin,

Great start on the questionnaire. The questions you ask are very consistent with your research question and should give you some useful data. I've left some suggestions in the questionnaire for you to consider using the Track Changes feature in Word. Don't be put off by the amount of feedback I've offered. It's really just a matter of question order and a few minor typos.

In general I see that you have a large number of open-ended questions which suggests that you might consider getting some of these data by interview. Open-ended questions take a longer time to answer and my concern would be that busy teachers might put the questionnaire aside for a time when they are not busy and you might not get as many responses as you'd like.

Is there information that you'd like to get from all the teachers in your school that is more general and would help you formulate your interview questions? As your research question relates to teacher's perceptions of play you can easily use the questionnaire to assess their perceptions of the benefits of unstructured and structured play that come out of your literature review. Using a likert scale (strongly agree to strongly disagree) you could ask questions about why play is important i.e., I believe unstructured play is important in the classroom because.... You have that as an open-ended question now, but you could pull some of the ideas of the literature about the value of play and list them each as a question. This would also get at their perceptions in a literature-based way. The benefit of this approach is that you might be more consistent terminology and a broader coverage of the issues. Then in the interviews you could probe a little deeper in terms of what types of play they use in their instructional activities. You could also ask an open-ended question at the end of the closed-ended questions like Are there other benefits of play not mentioned here? Please describe...

Do you think that teachers beliefs about play and what they actually do in their classrooms would be different? Are there barriers to teachers' use of play? If you think this is an important part of your project, you could ask some closed-ended questions in your questionnaire about the barriers as well.

I hope this is not discouraging. You are definitely on the right track with your questionnaire. An important part of developing a questionnaire is trying it out on a representative of you participants. I don't really know how much teachers think about play and so I don't know if my advice about the open-ended versus closed-ended questions is appropriate. Do you have a teacher you could try this out on to get some feedback about how long it takes and to see if the types of responses you get give you what you need? That would be ideal.

Elaine
A few more thoughts on Questionnaire by Elaine [2006, Oct 31]

Hi Erin,

I hope you check in to see this note. There are a couple of other points I just wanted to add. I like the way that you structured your questionnaire with a section on unstructured play in the classroom, a section on structured play in the classroom and a section on play at school in general. You could make that structure obvious to the respondents by using headings in the actual questionnaire. That helps to let them know the general areas you're interested in.

I was a bit concerned about sending you off into the literature thinking that you had to make a comprehensive list of all the issues related to structured and unstructured play in the classroom for your questionnaire. I don't think that's necessary. If there are particular aspects of play that you are interested in that would be a good way to focus your questions. I don't really know much about this area. Do teachers tend to incorporate unstructured play into their lesson plans? Why, why not? I'd be very interested in your ideas around this. It would help me to better understand what you hope to find out in your project.

I hope you start by having a teacher or even a few of your fellow classmates try out the questionnaire. Maybe someone in our little group would be willing to help out. The feedback you're after is:
1. How long did it take to fill in the questionnaire?
2. Where there any questions that you found confusing? If so, which ones and why?
3. After you read their answers, Does the questionnaire give you the kind of data you were hoping it would? Is there coverage of all the issues you were hoping to get answers to? Will the answers help you prepare for the interviews (i.e., selecting participants and writing questions).

Be reassured that writing survey questions always takes a few tries. What seems clear to you may not be clear to your participants. After all, by the time you've completed writing your questionnaire, you are the expert. Hope that clarifies my advice a bit.

Elaine

Erin's questionnaire by Erin [2006, Oct 31]

Hey Elaine,

Thanks again for your advice. I was feeling a little overwhelmed with this project - not because of what you wrote...but just because I wanted to get these surveys out at the end of last week and clearly that didn't happen. I also am not really sure how to go about sending them out. I know I need a permission form for the participants - I think [names program assistant] has sent us templates but I'm not sure about that. I just need to sort all these things out in order to actually get started and I think I don't know where to start!
About the survey... In a way, I am hoping to find out why teachers who do incorporate play into their classrooms do so. There are so many benefits to play (according to the research) and children are not receiving the same opportunities to play as we did when we were kids. I am wondering whether teachers recognize the benefits of play and are therefore inclined to use it in the classroom. I was hesitant to include a question in my questionnaire about the possible benefits because I didn't want to 'give away the answers' by listing possible benefits.

Basically I am interested in knowing why teachers use play in their classroom, or why they don't. I am interested in what schools can do to help promote the value of play to their students and if incorporating a form of play into classroom instruction is teachers' way of doing this (or should schools be doing other things outside of the classroom to get kids to play).

Thank you so much for helping me, I'm sure you are busy so I appreciate you taking this time to talk to me!

Thanks,
Erin

A few more thoughts on Questionnaire

Some more thoughts by Elaine [2006, Nov 02]

Hi Erin, That was a very helpful response you wrote. I now have a much clearer idea of what you were hoping to achieve with your questionnaire and with your project.

As you've probably figured out by reading the literature, you're asking some big questions. This is always a challenge when you have a finite amount of time and energy and resources in which to accomplish your project! It's easy to become overwhelmed.

A couple of things to keep in mind.

You said About the survey... In a way, I am hoping to find out why teachers who do incorporate play into their classrooms do so. This is clear from your survey questions and that's good. You are asking who incorporates play into their classrooms. That's a good survey question as they are closed-ended questions which you've already got in your questionnaire. The Why questions is a bit trickier. This is related to teachers’ beliefs and values and experiences. This is much more difficult to ask using a questionnaire because you would probably want to get more information than someone would write on a questionnaire.

Something else you said may help to figure out how to investigate the "Why" part of the question. You said I am wondering whether teachers recognize the benefits of play and are therefore inclined to use it in the classroom. Finding some answers to this question would help you understand the other thing you said I am interested in what schools can do to help promote the value of play to their students and if incorporating a form of play into classroom instruction is teachers' way of doing this (or should schools be doing other things outside of
the classroom to get kids to play). Do you think that the lack of play is related to teachers not recognizing the benefits or students not knowing how to play or the school not supporting play? It's likely some complex combination of all three plus other things not mentioned. But, don't worry, for your project you don't have to solve this whole problem. You just want to find out a little bit about one piece. It sounds to me from what you've said so far that you want to focus on teachers' classroom practices related to play. Who does it and why.

I'm unfortunately not as up on this literature as you so I don't know, but it might make a nice little research project if you could use your survey to find the teachers that use play, interview a couple of them about why, and then perhaps do a bit of observation in their classrooms, if you can, to see how their beliefs about play translate into classroom practice. This might not tell you what the school can be doing, but it would help you understand how play is being used by teachers who believe in it. This helps you answer your basic research question which is *Basically I am interested in knowing why teachers use play in their classroom, or why they don't.* It doesn't get at the Why not part, but you might be able to use the survey for that. Is there anything in what you've read so far that suggests why teachers don't include play in their classroom activities?

Finally, you said *I was hesitant to include a question in my questionnaire about the possible benefits because I didn't want to 'give away the answers' by listing possible benefits.* I understand this issue, it's quite tricky not to lead questionnaire respondents. There's a concept called social desirability in survey design which describes the tendency people have of answering questions to in a way that is socially acceptable. But if you use a scale (strongly agree to strongly disagree) then you aren't giving away the answers, your finding out what people think about the benefits. If you decide to go this route then run the questions by me in this forum and we can work on the wording.

Elaine

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**Methodology by Erin [2007, Feb 26]**

Hi Elaine,

How are you? It has been a long time since we have been in touch! I hope things are going well. I have a question about my Methodology section. I am going over it now and I am unsure if I have written enough about what I did. For my research I handed out surveys and then interviewed 2 participants chosen from the surveys that were handed back to me. Under my section called Instruments of data collection I talked about the survey and what type of questions I used, and then I included a part about how/when/where I conducted the interviews. Is that enough? My Methodology section isn't that long and I got worried - but what I did was really straightforward so I'm not sure what else I can write!

**About the Methods section by Elaine [2007, Feb 27]**
Hi Erin,

Would you feel comfortable posting what you've got so far. It's difficult for me to give you feedback without seeing what you've got. The Methods section is often quite straightforward and it should provide enough information that the reader can understand how you collected your data and why you made the choices that you did. Always keep your audience in mind when you write. Will your reader know what kinds of questions you asked, or do they need that information to understand the results? If so, then include a paragraph describing the survey and the content of the questions you asked. Does the reader need to know how you implemented the survey, were there any problems you encountered, how did you handle them, will the implementation affect the results in some way? If so, you should describe how the survey was handed out and returned.

These are examples. Basically you should include anything that helps the reader understand the results and explains why you collected data using the methods you did.

I hope that helps, and feel free to post what you've got so far,

Elaine

Analyzing and Interpreting the Data

There are very few examples of students and mentors discussing data analysis in the ORM. However, in the following exchange in Emma’s research group, one of her students requested help with using SPSS to analyze some of her data.

Hi Emma,
I am almost done collecting all of my data for my project and will need to do my analysis over the holidays. My supervisor has recommended that I use SPSS for the qualitative analysis of the questionnare responses. I wanted to know if you could maybe give me a tutorial on how to use the program. I think I have used it in undergrad, but really can't remember... I'd have to see it to remember. My supervisor also mentioned that I can get a licensed copy to take home and I guess upload on my computer.
Would it be possible to meet before the break regarding SPSS?

Thanks,
Alexis

p.s. I'm going to the conference from the 13th-15th, but I'm sure I won't be attending every workshop/session. Also, I will be going away for the holiday's on the 16th.
SPSS tutorial--mentor team folks, please take a look by Emma [2006, Dec 03]

Hi Alexis,

It has been quite a long time since we last talked! Good to know that everything went well with data collection.

As for SPSS, my experience and knowledge about it is limited to one or two sessions of a methodology class (my MA research was qualitative and I didn't need statistics for it). So I think I'm not the best person to help you with SPSS. But I'm sure at least a couple of mentors are SPSS experts. I will send them a message and ask them to contact you if possible.

Meanwhile I found this link, it is a beginners tutorial for SPSS.
http://www.[source].ca/courses/c1/spss/toc.htm
[The computer lab] offers drop-in help with SPSS too. You can check this link
http://www.[source].ca/ec/academic_computing/statsconsulting.php

I'll get back to you soon.

Emma

SPSS... by Kim [2006, Dec 04]

Hi Alexis

I have used SPSS on a couple of research projects and taken the SPSS courses through [names a campus library], so I would be happy to go over things with you before you leave for the holidays.

We could meet on Wednesday if you like since that's your "day off". We could try to meet during a lunch time if that's better for your schedule, but my instincts tell me that we will need a bit more time.

Let me know what day you want to meet. And be sure to bring any data you have already and we can start plugging things into a data file for you.

Also...you can purchase a student copy of SPSS through [names a campus library] for $40. It will work on a MAC or PC platform - just let them know which you use.

Cheers,

Kim

SPSS help on wednesday Dec 6? [2006, Dec 05]

Hey Kim!

Thanks for the reply!
I am conducting some more questionnaires tomorrow (Wednesday Dec 6) at 2:30 and 4:30pm. I could definitely meet with you before then. Or, if you have time, I
could meet with you on Monday Dec 11, around 12:15 or Tuesday Dec 12 during the day.

Please let me know what works for you.
I'm also conducting interviews for my research over the next few days, so my availability may change if someone wants to do an interview on Mon or Tues next week, but I'll let you know.

I haven't begun to code my data yet, but I would need to use SPSS for a questionnaire I did, and for some responses to an interview.

Also, I thought I had used SPSS in undergrad, but I just found the program and it was SYSTAT that I used. Any chance they're similar?? (*fingers crossed*)

Also, do you think there is anyway I could get a copy of SPSS for free? Being the poor student I am, I don't think I can justify paying $40 for the program. But I'll talk to my supervisor again and see if she knows anything...

Thank a bunch.
You can also email me [provides her email address] <-- I check this more often.

Thanks again,
Alexis

After a few more exchanges online, Kim and Alexis met in the instructor-participant’s research computer lab to do the SPSS training.

**Reporting and Evaluating the Research**

Most of the students involved in discussions with mentors in the ORM did not get to the stage of conversation about reporting and evaluating their research. However, one of Elaine’s students came back to the ORM in late March to share her final report.

Michelle's Draft Research Paper by Michelle [2007, Mar 30]

Hello Elaine,
I have just sent this draft to [names advisor], my advisor. The visual organizer chart will be included as a figure in the final copy.
If you have any feedback, it would be greatly appreciated. Otherwise, thank you for giving your assistance and support throughout the way!
Michelle

Michelle's Draft Conceptual Chart - organizer
**Developing and Implementing an Action Research Plan**

In general, there were not many research projects that took on the form of an action research study. There were two MA-T students in Elaine’s research group who had originally started off planning an action research study in the area of environmental education, in collaboration with an external agency however, their projects were changed mid-way through the year due to a delay in funding for the project. They discussed the nature of the switch in focus with Elaine - and in the end, neither student adopted an action research methodology.

Although many students initially discussed the potential of carrying out action research topics in their notes in the ORM, in the end, there was only one student (Alexis) - in Emma’s research group - who conducted this type of study. Her project was focussed in the area of science education. She wrote the following message to Emma early in the year:

Thanks for the feedback! by Alexis [2006, Sep 29]

Hi Emma,

Thanks for the feedback.

I've actually started collecting data etc. for my research project... I'm hoping to be done by December.

With respect to my Research question, I have revised it a bit... here's what my supervisor and I came up with (see attached file).

For my project I will have an experimental and control group. Both groups are J/J science specialty classes of preservice teachers here at [names university]. I have conducted baseline questionnaire's with both groups. I will also conduct questionnaire's after the fall practicum, in december. I am going to do a presentation/workshop with the experimental group on the gendered nature of science and how to keep both sexes engaged when teaching the science curriculum. That workshop will be on Oct 11.

Both groups will go out on practicum and I will see whether their pracitcum experiences and the knowledge gained during their pre-service training changes
their opinion about gender and science.

In addition to the questionnaires, I'm also conducting interviews (both pre- and post-practicum) with both groups to gain more insight into the beliefs of pre-service teachers. 3 students from the control group and 3 students from the experimental group have been interviewed. I will also interview them after practicum to see how their beliefs have changed.

Here's a little blurb explaining why I have chosen to study this topic...

"While in high school, I attended a single-sex school. As a student I was somewhat aware of the gender equity issues in education, but did not know about specific research findings. Furthermore, I was unfamiliar with the many forms that gender inequity took in the classroom. Through my volunteer experience tutoring students, I became more aware of the gender differences with respect to learning and began to question some of the patterns, trends and behaviours I observed. When I entered the [names program], I wanted to learn more about the factors that contributed to the under representation of women in careers involving mathematics and science. I was interested in learning more about what I may be doing in the classroom to discourage female students from pursuing higher level science, mathematics, and technology courses. Moreover, I wanted to discover what other researchers believed teachers could do to promote or ensure gender equity in the classroom.

To learn more about this topic, I enrolled in an elective course entitled [names course on gender issues in science, math and technology education]. Over the course of the semester, this course opened my eyes and made me more aware of various gender issues with respect to science, mathematics and technology (SMT) education. This elective examined women’s and girls’ historical role and participation in SMT and current research that describes the trends and obstacles that contribute to their marginalization and/or exclusion. Also, the course touched upon the recent interest in boy’s education and how it relates to the under representation of women and girls in SMT.

As a result of taking this course, I have become more conscious of the decisions I make in the classroom. The knowledge I gained was invaluable to me and is knowledge that all pre-service teachers should possess before entering the classroom. Having been made aware of these gender issues, I began to wonder whether other pre-service teachers (especially those with a specialization in the Sciences) were being made aware of these gender equity issues and whether they were being equipped with the skills and strategies to recognize and prevent gender inequities in the classroom. Thus the purpose of my research project is to determine the knowledge and beliefs held by pre-service teachers specializing in science education with respect to the differences in students achievement and interest of male and female students in the sciences. In addition, I want to determine whether pre-service teachers specializing in science receive any resources or practical strategies for the classroom during their training."

Hope that makes things a little more clear!

~alexis

Research Questions
While most of the students were still working out their research topics at the beginning of the year (as evidenced by discussion in the ORM), Alexis had already planned and begun implementing her action research project - which is described in her note above. Later, in December, Alexis came back to the ORM to request assistance with learning how to use SPSS (a statistical software) to analyze her data. Although, her mentor was not familiar with the program, she was able to get assistance from one of the other mentors (who is also the researcher in the design study).
## APPENDIX S: Constraints Addressed in Innovation 2 of the Design Study

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<td><strong>Organizational Constraints</strong> (Program priorities and expectations, course expectations, admission criteria, scheduling, job descriptions, incentives/disincentives)</td>
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| 1 Organizational | According to F2, there is an expectation that the students will complete their data collection during their first teaching placement in the second year of the program. | **Implication(s):** The bulk of data collection may occur by October/November, in the practicum location.  
**Design Strategy:** Research supports were put in place from the beginning of the year. |
| 2 Organizational | According to F2, although many of the faculty that teach the Year 2’s have elements of research in their courses, there’s not officially “a research course” during the second year of the program. | **Implication(s):** Students carry out their research independently, outside of coursework.  
**Design Strategy:** Research support was connected to the Psychology course since it is not formally connected to any other course. Supports connected to (made sense with) concepts covered in the course (e.g., social constructivism). |
| 3 Organizational | According to F4, exploring the use of technology in teaching is one of the major components of the MT program. | **Implication(s):** Use of technology in teaching is a program priority.  
**Design Strategy:** The research support was housed within an online discussion forum called Knowledge Forum®. |
| 4 Organizational | According to F5, students are expected to conduct the literature review, data collection and write-up for their research projects during the second year of the program. | **Implication(s):** The bulk of the research project is likely to be carried out during the second year of the MA-T program.  
**Design Strategy:** The research support targeted second year students. |
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| 5 Organizational | Students are required to use technology to complete coursework, and as a program communication tool. | Implication(s): Second year students will have some experience with technology for completing coursework and as a communication tool.  
*Design Strategy:* Knowledge Forum® is used as a discussion tool to support work related to the research project (which also connected to work in the Psychology course). |
| 6 Organizational | There is not a lot of time or opportunity built into the program for students to engage in independent study or carry out their research projects. | Implication(s): Students need to fit the research project around other program priorities.  
*Design Strategy:* In the Knowledge Forum®, students can communicate with their peers and access help from the mentor, at any time (as they need it). |

**Team Constraints** (How groups of people work together to make decisions and carry out goal-directed activity; communication)

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| 7 Team   | F2 mentions that there was a lack of consensus among faculty, regarding who would be supervising students, and whether formal supervision was actually needed. | Implication(s): Some students may not have immediate access to a supervisor, or until their research is already in progress.  
*Design Strategy:* Students have immediate access to the mentor through Knowledge Forum®.  
Course-based strategy - students have immediate access to F1 through the Psychology reflection journals, which can focus on their research.  
*Program change* - an Organizational decision is made |
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<td>by MA-T faculty to assign students to supervisors prior to the beginning of the second year of the program.</td>
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| 8 Team   | According to F2, the amount of help students need with the research varies during the year, and also between students, but there are times when there will be a flurry of contact with students, when they feel uncertain about details of their research, or when they are under the pressure of time to complete the research. | Implication(s): The need for research support among students may vary at different times throughout the year.  
Design Strategy: The researcher regularly checks Knowledge Forum® for new posts from students.  
The email notifications are turned off, since many students in Innovation 1 noted that these were not useful and/or annoying. |
| 9 Team   | Students often have little contact with the university and their cohort peers during practicum. | Implication(s): Students have little contact with their peers and the university at a time when many are collecting research data.  
Design Strategy: Students can access their peers, the mentor and F1 at any time, through Knowledge Forum®; including during practicum. |
| 10 Team  | Students often look to each other for support and advice. | Implication(s): There is likely an existing network of peer support in the program.  
Design Strategy: Students can create their own online groups based on research interests and/or existing peer networks, to discuss their research. |
<p>| 11 Team  | According to F2, the associate (partner) | Implication(s): Students may not receive sufficient support for |</p>
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|           | schools do not always support the students in carrying out their research, despite the fact that they’ve agreed to do this as part of their role. | carrying out their research in their practicum settings (where many collect their data).  
*Design Strategy:* Students have access to research support during practicum, through Knowledge Forum®. |
| Psychological Constraints (Personal competencies, understanding, priorities, skills, feelings) |                                                                                                                                                 |
| 12        | Psychological                                                                            | Implication(s): Program integration is a priority for F1. Possibility to link Psychology to research.  
*Design Strategy:* The research supports are linked to the Psychology course, and to the online mentorship. |
| 13        | Psychological                                                                            | Implication(s): Collaboration is a priority for F1.  
*Design Strategy:* The research support is designed to scaffold collaboration around the research projects. |
| 14        | Psychological                                                                            | Implication(s): Possibility to link other graduate students to support research.  
*Design Strategy:* One graduate mentor monitors activity in the online mentorship, and provides feedback and assistance as requested by students. |
| 15        | Psychological                                                                            | Implication(s): There may be variability of research competencies among students.  
*Design Strategy:* The online |
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<td>16</td>
<td>Psychological</td>
<td>According to F5, the MT students are often working on their research right up until the end of the year - just before marks are due for faculty.</td>
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<td><strong>Implication(s):</strong> Students may need help to balance work involving the research throughout the year, around other priorities.</td>
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<td><strong>Design Strategy:</strong> Course-based strategy - reflection journals in which students can get feedback on their thinking/work-in-progress related to their research (due at the end of first and second semester).</td>
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<td>The online mentorship is designed to provide regular and immediate feedback and assistance to students throughout the year.</td>
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<tr>
<td>17</td>
<td>Psychological</td>
<td>According to F5, some faculty find it challenging to deal with the demands of a combination, pre-service and graduate program (e.g., practicum supervision and research support).</td>
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<td></td>
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<td><strong>Implication(s):</strong> Some faculty may need help to manage some of the demands around research supervision.</td>
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<td><strong>Design Strategy:</strong> Access to the online mentor and peers provides opportunity for students to seek help and feedback from multiple sources, rather than reliance on supervisor alone.</td>
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<tr>
<td>18</td>
<td>Psychological</td>
<td>F6 doesn’t believe students are always well supported (e.g., given access to quality teaching, access to supervisors).</td>
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<td><strong>Implication(s):</strong> The quality of research supervision may vary; some students may need more support.</td>
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|          |                           | **Design Strategy:** Access to the
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<tr>
<td></td>
<td>online mentor and peers provides opportunity for students to get help in ways they may not be getting through their supervisor alone.</td>
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<td>19 Psychological</td>
<td>There is a perception among some students that the research project is not really valued in the program.</td>
<td>Implication(s): The student research needs to be recognized and acknowledged within the program (and perhaps outside the program). Design Strategy: Course-based strategy - to have an end of year research conference in which students present their research to peers, the mentor and faculty. Online mentorship - students have online access to research abstracts from students in Innovation 1 so student work can connect from year to year.</td>
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<td>20 Psychological</td>
<td>Students perceive a disconnect between elements of the program (e.g., between different courses), including between the research and the rest of the program.</td>
<td>Implication(s): The student research needs to be connected to other aspects of the program. Design Strategy: The work and concepts covered in Psychology, supports work around the research through the online environment.</td>
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<tr>
<td>21 Psychological</td>
<td>Research skills among students in the program are varied, and often limited.</td>
<td>Implication(s): Some students may need more support than others to carry out the research project. Students may be lacking basic research knowledge and skills. Design Strategy: A doctoral mentor (trained in education-based research) is available</td>
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| 22         | Psychological Atoms to infuse technology in various elements of the program have been seen by students as an “add on”, or extra work, and not necessarily something that added a lot of value in their learning experience. | *Implication(s)*: Technology should support work that students are already doing.  
*Design Strategy*: The online mentorship is designed to support the student research (a major component of the program); it is not just about students learning how to use technology.  
Course-based strategy - students can access the online mentorship directly from their Psychology discussion forum; they do not need to access a separate online program. |
| 23         | Psychological Students perceive that there is some value in getting comfortable with technology, and that technological skills are an important competency to have for the program. | *Implication(s)*: Opportunities to learn to work with new technology is valued among some students.  
*Design Strategy*: Knowledge Forum® is a new technology for students in the program - they do not use it in other courses (outside the Psychology course and the online mentorship). |
<p>| 24         | Psychological Some students enter the program with a lack of experience with                | <em>Implication(s)</em>: Technology competencies may vary among students. Some students may |</p>
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|          | technology and/or techno-phobic tendencies. There is some resistance among students to using technology. | need extra technological support.  
*Design Strategy:* Class time in the first few Psychology classes is devoted to learning how to use Knowledge Forum®.  
Students are offered extra support from the researcher, upon request. |
| 25 | Psychological [NEW Emergent Constraint] | Many students are not comfortable sharing their research with others; some are only comfortable sharing their research once it is complete. | *Implication(s):* Some students consider the research (or aspects of the research) to be private; they may not be willing to share all aspects of their research.  
*Design Strategy:* Course-based strategy - private reflection journals in which students can discuss their research with F1.  
Online mentorship - students can create private, open, individual and/or group folders/views to work on their research.  
Scaffolded design - students are given private and public space to discuss their research, with the goal of moving towards public. |
| 26 | Psychological [NEW Emergent Constraint] | Face-to-face contact is important to students, in particular around the research projects; some students have difficulty taking advice, and/or accepting feedback from others who are ‘at a distance’. | *Implication(s):* Students need some face-to-face contact with people with whom they discuss their research.  
*Design Strategy:* There is only one research mentor for the online mentorship (the researcher); someone they see face-to-face on a regular basis.  
The researcher/mentor attends |
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<td>all Psychology classes, which are held face-to-face.</td>
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<td>Course-based strategy - through private online reflection journals students can receive feedback from the instructor-participant, who they see face-to-face in class (Psychology).</td>
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APPENDIX T: Examples of Student Notes from the SORSC

The Insularity of Research by Marian. [2008, Mar 06]
My MRP [Major Research Project] was a great experience. But, in some ways, it was a foregone conclusion. I already knew that my AT [Associate Teacher] was a brilliant teacher and an excellent global educator, so my goal was to observe and deconstruct her methods in order to understand that challenges associated with instituting global education theory, something I plan to do myself eventually. It was extremely meaningful and useful project and I enjoyed it. But it was, largely, for me. My AT is already a global educator. The school is a global education school. Even if they value my perspective and are interested in my observations, they don't really need me to do this project in any way [...] In my current incarnation as an [MA-T] student and future teacher-researcher, I want to avoid intellectual hoop-jumping as much as possible. Whatever I do, I want to see a potential contribution to someone or something. If my research benefits or truly informs even one person, it's worth doing.

Breaking Down the Walls by Sam. [2007, Dec 21]
Time did not allow me to interview one of my participants and another one backed out of the study. Normally, I would have been discouraged. But, I had encountered trouble before with my data collection and I was determined to get through this. With my action research completed and ready to analyze, I rescheduled a time to interview the teacher that was still committed to being a participant in my study. This was important to me because I wanted to secure at least one teacher at the school I conducted my action research in for two reasons. Firstly, it helped to support my action research and keep my study to one school which was essential due to simplicity and time constraints. Secondly, this school, despite being in an upscale area, had significant violence and specific strategies to deal with such violence. So, this school was important for my study.

Frustration and Changes by Sam. [2008, Apr 12]
The most frustrating part of the whole research process I found was getting parts of the MRP [Major Research Paper] completed at certain intervals during the year. I really liked how parts of the MRP were broken up and due at different times. I found this to be very structured and not overbearing. But, with all the other work due in the [MA-T] program around the same time and practicum, it was extremely difficult. Even when parts of the MRP were completed by the due dates, I know that they were not my best quality. Regardless of the fact that it was done and
completed to my research supervisor’s satisfaction, I personally had a problem with not submitting my best work especially when it was my own research. I know that I could have used more time to complete the MRP and do a better job.

Reflection 2 by Angela. [2008, Apr 13]

One area of this research process that I have truly come to value is my affiliation to a research group – made up of other teacher candidates conducting their own research. And even though most of us have undertaken very different areas of research (one other person in my group is also studying community) meeting as part of this group has been incredibly beneficial to me. We meet fairly regularly to discuss our progress (or lack of it) and we inevitably end-up having some really great discussions. Most of the time I benefit from the feedback meant for my colleagues and am able to incorporate this into my own research. These group meetings have reminded me how very closely connected oral skills are related to writing and reading. Although I have read so much on my area of study, it is when I’m forced to articulate my thoughts that I’m better able to synthesize the information. Most of the time, I leave these group discussions ruminating on ideas I thought I had already “nailed-down”. I love when this happens.

Also, one final note with respect to the research process applies to the “enormity” of my research. The truth is I’m not completing any groundbreaking kind of work and that’s OK. I think when I originally was considering my topic of research while in my first year of the program, I was thinking this was going to be so awesome because I thought I’d be doing something of substance. The truth is, teacher-researchers are no different than most researchers. For example, how is studying some single-celled species who lived several hundred-thousand years ago have any relevancy to us today? I’m certain I don’t know the answer to that, but the point is the person who is undertaking this research can…they can make the connections and see the relevancy. They don’t need to do something groundbreaking – just meaningful.

Reflection 2 by Naomi. [2007, Dec 13]

Reflection 2: Something I hate about doing research as a beginning teacher…

Motivation. That is something I do not appear to have at the moment when it comes to my research! I am not sure whether it has to do with changing my topic and not feeling that I am being supported enough in this process but all I know is that I am lacking the intrinsic motivation to carry out this
research. It could be because I have just looked over the responses from my surveys and that they lack detail. I am hoping that once I get my interviews with teachers set up and dialogue with them that I will start to get excited about my findings.

Aristotle once said that to learn is a natural pleasure. I love learning so I find it strange that I am not as drawn to my research as I thought I would be. Intrinsic motivation is the desire to be effective and to perform a behaviour for its own sake and can be seen in students who approach schoolwork looking for a challenge and do it out of enjoyment and interest (Woolfolk, Winne & Perry, 2006, p. 360). Extrinsic motivation, however, is a desire to perform a behaviour due to promised rewards or threats of punishment (Woolfolk et al., 2006, p. 360). I feel as though the only reason I am doing this research is because I need to do it to graduate.

A professor recently told me that my research does not matter, that I am not going to find anything that will influence education. That statement affected how I look at my research project and I need to overcome this. What is the point in doing this research if it will not be valuable? I guess that it will be valuable to us as future teachers because I do believe that action research in the classroom is important but at the same time I want my research to mean something to others. I might feel that my research would be more useful in my classroom as it would guide my future instruction and would be able to improve student learning.

What I hate about this research project right now is that I do not enjoy feeling as though I am only extrinsically motivated to carry out this project. In order for me to feel better about this I need to feel as though the research process itself is the reward. I am really hoping that my attitude towards research changes soon because it goes against my character. I majored in Psychology in my undergrad and I loved every minute of it. I did not do a thesis, though, and I am wondering if that experience might have better prepared me for this research project. I may have encountered this lack of motivation earlier and learned how to overcome it which would have made this year a lot easier. However, I know that this is a learning experience for me and that once I get out of this slump I will be better prepared to face a lack of motivation when I have my future classroom. I look forward to becoming intrinsically motivated once more!

A few months later, Naomi wrote the following:

Reflection 4 by Naomi. [2008, Apr 02]

Something I love about doing research as a beginning teacher…
A few months ago I did not envision myself choosing this topic for my reflection. I was not feeling motivated to complete my research and did not think I was going to get anything out of this process. I was actually surprised, however, by how much I enjoyed analyzing my data. I did not think I was going to be so fascinated by the responses my participants gave in the interviews. I found that the participants in my study were able to clearly articulate their beliefs about their practice. They knew what they were doing in their classroom and why they were doing it. I found that these conversations with teachers inspired me to really reflect on my beliefs about teaching.

After spending so much time pouring over my transcripts I wanted to be able to go back to the school and observe these teachers more. I have found that throughout my time in this program I have learned the most from the students and Associate Teachers in the classrooms where I have been placed. While I am constantly buying professional resources to come up with ideas for my lessons it is through carrying out the lessons and discussing the improvements on and successes of my lessons that I truly learn what it means to be a teacher.

At this point in time I would love to do a follow up to my study or have someone else do a follow up. I found it really interesting that even though the teachers believe that Math should be taught using hands-on activities they all provide their students with worksheets to complete while they are meeting with small-groups. I think that in the future it would be helpful to introduce Math learning centres into these teachers’ classrooms and see if that would influence their decision to use learning centres. These teachers seemed very open to trying new ideas and I think that if I could come up with some specific Math learning centres they might be willing to try them out. It would also be interesting to find out if learning centres increase student motivation to do Math. One of my participants was very proud of the way he teaches his Math class so it might be fun to compare the motivation of students in his class with the other grade six class. Once again, I am very surprised that my research project has sparked this interest in me to investigate some more. Whether or not I go forward with these ideas I can see myself incorporating learning centres of some sort in my future classroom. This process has encouraged me to discover and incorporate new ideas in my lesson planning and I am very much looking forward to having my own classroom in which I can carry out another action research study. In the future I would like to study my students directly instead of focusing on teachers’ beliefs. What I love about research is that it has inspired me to ask more questions and reflect more upon my own teaching practice.
Now, it is the end of March, only a few weeks away from the due date of the MRP [Major Research Paper], how do I feel? To be completely honest, I’m as scared as ever. With a board interview and a large handful of essays and other assignments to get done before the due date of the MRP, I wonder yet again, how will this thing ever get done? My fear now is not that I am not competent enough to do a paper of this magnitude, but that there isn’t the time for it. We are so ridiculously overloaded right now, that I can’t even give the research the priority it deserves. We’re given a week off to do our research, yet I can’t even spend one of those five days working on it. Well I guess some how, a miracle will happen, and like all other things we are expected to get done in life, this MRP will be handed in before I graduate. That, will be a wonderful day…