Mapping a teacher candidate’s journey through inquiry and into practice

by

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B.Sc., University of Victoria, 1996

A Thesis Submitted in Partial Fulfillment
Of the Requirements for the Degree of

MASTER OF ARTS

In the Department of Curriculum and Instruction

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University of Victoria

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Supervisory Committee

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Supervisory Committee

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Abstract

This study examines the lived experience of teacher candidates through a professional inquiry process and the influence of that experience on their eventual teaching practice. Literature in this area typically follows teacher candidates and teachers through curriculum and instruction pedagogy coursework and then into the classroom to observe the incorporation of inquiry strategies and changes in disposition towards inquiry. This work fails to address a teacher candidate’s experience through their own personal open inquiry process and whether or not that experience transfers into their teaching practice. A nested case study approach - including both quantitative and qualitative data - were used to provide insight and build understanding towards the following questions: 1) What is the effect on a teacher candidate’s likelihood to employ an inquiry approach to science in their classroom following their own participation in an open-inquiry process during their teacher education? 2) How does participation in an inquiry process influence a developing teacher’s understanding of teaching and learning? Teacher candidates and teachers at varying stages of practice, completed a survey and three recently certified teachers were interviewed to explore the use of inquiry in their teaching. The evidence suggests a key component to affecting the incorporation of inquiry approaches into the classroom was that personal experience with inquiry served to unsettle held beliefs and led to a change in disposition towards inquiry. This study also explores the implications for the inclusion and importance of inquiry experiences early within teacher education programs.

Keywords: inquiry, teacher education, science education, teacher candidates, teaching and learning beliefs
Table of Contents

Supervisory Committee ........................................................................................................... ii
Abstract................................................................................................................................... iii
Table of Contents .................................................................................................................. iv
List of Tables ............................................................................................................................ viii
List of Figures ........................................................................................................................... ix
Acknowledgements .................................................................................................................. x

Chapter 1: Introduction ........................................................................................................... 1
  Historical Foundations of Inquiry ...................................................................................... 3
  Students in a World of Inquiry ......................................................................................... 5
  Teachers in a World of Inquiry ......................................................................................... 6
  Theoretical Framework ...................................................................................................... 8
  Role of the Researcher ........................................................................................................ 9

Chapter 2: Literature Review ................................................................................................. 10
  Understanding of Inquiry ................................................................................................. 11
  Beliefs about Teaching and Learning ............................................................................ 12
  Teacher Candidate Confidence with Science Content ................................................ 13
  Implementation of Inquiry ............................................................................................... 15
  Professional Learning and Partnering Strategies in Inquiry ......................................... 16
  Research Question ........................................................................................................... 19

Chapter 3: Methodology ......................................................................................................... 19
  A Nested Case Study ....................................................................................................... 20
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context and Participants</td>
<td>21</td>
</tr>
<tr>
<td>Methods of Data Collection</td>
<td>24</td>
</tr>
<tr>
<td>Surveys</td>
<td>25</td>
</tr>
<tr>
<td>Interviews</td>
<td>26</td>
</tr>
<tr>
<td>Data</td>
<td>27</td>
</tr>
<tr>
<td>Recruitment of participants</td>
<td>27</td>
</tr>
<tr>
<td>Analysis</td>
<td>28</td>
</tr>
<tr>
<td>Chapter 4: Findings</td>
<td>29</td>
</tr>
<tr>
<td>Participant Demographics</td>
<td>30</td>
</tr>
<tr>
<td>Overall Survey Results</td>
<td>31</td>
</tr>
<tr>
<td>Identification of participants working in the field and using inquiry</td>
<td>32</td>
</tr>
<tr>
<td>Level of comfort through inquiry</td>
<td>33</td>
</tr>
<tr>
<td>Significant learning</td>
<td>35</td>
</tr>
<tr>
<td>Context where inquiry is being used</td>
<td>38</td>
</tr>
<tr>
<td>Change through the inquiry experience</td>
<td>39</td>
</tr>
<tr>
<td>Teacher candidate understanding of inquiry</td>
<td>43</td>
</tr>
<tr>
<td>Qualitative Findings from Interviews</td>
<td>44</td>
</tr>
<tr>
<td>Tara’s Story</td>
<td>46</td>
</tr>
<tr>
<td>The inquiry experience</td>
<td>46</td>
</tr>
<tr>
<td>Approach to learning from an inquiry perspective</td>
<td>48</td>
</tr>
<tr>
<td>Inquiry experiences in the classroom</td>
<td>51</td>
</tr>
<tr>
<td>Challenges to implementing inquiry</td>
<td>54</td>
</tr>
<tr>
<td>Supports for inquiry</td>
<td>56</td>
</tr>
<tr>
<td>Chapter Title</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Janet’s Story</td>
<td>57</td>
</tr>
<tr>
<td>The inquiry experience</td>
<td>58</td>
</tr>
<tr>
<td>Approach to learning from an inquiry perspective</td>
<td>59</td>
</tr>
<tr>
<td>Inquiry experiences in the classroom</td>
<td>60</td>
</tr>
<tr>
<td>Challenges to implementing inquiry</td>
<td>62</td>
</tr>
<tr>
<td>Supports for inquiry</td>
<td>63</td>
</tr>
<tr>
<td>Joan’s Story</td>
<td>64</td>
</tr>
<tr>
<td>The inquiry experience</td>
<td>64</td>
</tr>
<tr>
<td>Approach to learning from an inquiry perspective</td>
<td>65</td>
</tr>
<tr>
<td>Inquiry experiences in the classroom</td>
<td>67</td>
</tr>
<tr>
<td>Challenges to implementing inquiry</td>
<td>70</td>
</tr>
<tr>
<td>Supports for inquiry</td>
<td>74</td>
</tr>
<tr>
<td>Common Experiences and Themes between Participants</td>
<td>75</td>
</tr>
<tr>
<td>Chapter 5: Discussion and Conclusion</td>
<td>78</td>
</tr>
<tr>
<td>Effect on the Likelihood to Employ Inquiry</td>
<td>79</td>
</tr>
<tr>
<td>An upset to held values and beliefs</td>
<td>80</td>
</tr>
<tr>
<td>Change in disposition towards inquiry</td>
<td>80</td>
</tr>
<tr>
<td>Engaged in professional learning</td>
<td>81</td>
</tr>
<tr>
<td>Value placed on community</td>
<td>83</td>
</tr>
<tr>
<td>Challenges Experienced with Implementation</td>
<td>83</td>
</tr>
<tr>
<td>Influence on Understanding of Teaching and Learning</td>
<td>84</td>
</tr>
<tr>
<td>Challenging their concepts of learning</td>
<td>85</td>
</tr>
<tr>
<td>Challenging their ideas about the role of the teacher</td>
<td>86</td>
</tr>
</tbody>
</table>
The language of learning .................................................. 88
Unexpected Findings .......................................................... 89
Implications and Limitations .............................................. 91
Future Research .............................................................. 92
Conclusion ........................................................................ 93
Reference List .................................................................... 95
Appendices ........................................................................ 103
Appendix A: Research Timeline ......................................... 103
Appendix B: Survey Questions ............................................. 104
Appendix C: Interview Questions .......................................... 106
Appendix D: Recruitment Script ........................................... 107
Appendix E: Survey Cover Letter for Implied Consent .......... 108
Appendix F: Research Consent for Interview ....................... 109
Appendix G: Ethics Certificate of Approval ......................... 111
List of Tables

Table 1  Summary of participants and demographics.................................................................30
Table 2  Breakdown of positive responses to survey questions on the inquiry project ..............32
Table 3  Frequency of responses by participants during semi-structured interviews.................76
List of Figures

Figure 1. Timeline of research. ................................................................. 22
Figure 2. Participants’ entry year to Teacher Education, work history and inquiry usage. ........... 33
Figure 3. Comfort with an inquiry approach. .......................................................... 34
Figure 4. Categories of significant learning. .......................................................... 36
Figure 5. Inquiry approaches within subjects. .......................................................... 39
Figure 6. Inquiry experience effect on teacher candidate. .......................................... 40
Figure 7. Mapping inquiry into practice by Group 1, 2, & 3. ...................................... 41
Figure 8. Participants description of inquiry after project. .......................................... 44
Acknowledgements

I would like to acknowledge and thank a number of people, without whom this journey would not have been possible. First and foremost, I would like to thank my supervisor Dr. Todd Milford, whose continual guidance, encouragement, feedback, and genuine interest in my research has made all the difference. I would like to thank my committee member and professor, Dr. Kathy Sanford, who inspires me to think outside the box and question that which goes unquestioned. To both Dr. Milford and Dr. Sanford, your guidance and thought-provoking feedback throughout the writing process of this thesis was invaluable and has pushed me to be a better writer, researcher, and educator. I would also like to thank Dr. Carol Rees for agreeing to serve as my external committee member, whose research in teacher education inspires me in my work with teacher candidates. I would like to acknowledge the amazing support of my colleague, Kerry Robertson, your ongoing encouragement, advice, and enthusiasm has made the completion of this thesis possible. This research would not have been possible without the teacher candidates and teachers who were willing to participate by providing their experiences and insights into their practice; thank you for sharing your stories and a piece of who you are. I hope this work serves as an encouragement to you and the wonderful work you are doing with your students. Last, and certainly not least, I would like to thank my family: my husband, Russ, whose unwavering support, patience and love has been incredible through my whole program, but especially through the extremely intense writing phase; and my daughters, Natalie and Jillian, who ask great questions, were understanding when I was buried in research, and who continue to inspire me every day to find joy in life’s moments.
Chapter 1: Introduction

As an educator, my beliefs about learning and teaching have changed throughout my career and continue to evolve. Early in my career several experiences had long lasting effects that shaped my practice, the most significant of which were a re-examining of my teacher directed learning approach, and an open inquiry experience with my students. As a secondary science teacher, hands-on activity was an excellent way to engage students and it informed a large portion of my teaching philosophy. However, a few years into my practice, I noticed I wasn’t taking risks in my teaching approach, and as I examined my classroom routines, a predictable pattern emerged: stand and deliver, teacher-directed learning, reinforced with a script for students to follow as they produced their hands-on product. It was a comfortable position as a beginning teacher, as it was familiar to me as a student and was a promoted approach through my teacher education: direct the instruction, control the environment, and know the expected outcomes. Within this first critical reflection on my practice as an educator, I knew my students were capable of more independence and critical thinking, but a change in my practice would require me to let go of trying to control the learning and be open to not having all the answers.

The second change in my teaching practice, and ultimately the most significant shift in my philosophy about learning, took place six years into my career while being immersed with a group of students engaging in a collaborative inquiry experience. My inquiry journey began while I was teaching at a school which ran British Columbia (BC) curriculum along with the International Baccalaureate (IB) program. As part of the IB diploma program (Grade 11 and 12), students participate in a Group IV project, which is an interdisciplinary science project (International Baccalaureate, 2018). The IB criteria asks students to engage in a collaborative, student-directed, scientific investigation. At my school, however, the project had veered away
from the true intent of the project, which was to focus on the process of collaborative investigation, and instead became all about the product. Students would spend months doing research; collaboration with their peers was minimal as they used a divide and conquer approach, by simply splitting up the tasks and assigning them to group members, with no further discussion or connection to one another. The project culminated in a public PowerPoint presentation that was followed by a scrutinizing question period conducted by the director and head of school. It was in this way that the Group IV project moved away from its original intent, which was for students to enter into inquiry, interact with one another, consider perspectives from other areas of science, and present their learning (International Baccalaureate, 2014).

Following an IB professional development opportunity and through conversations with my colleagues, I realized the need to refocus the project. As the IB chemistry teacher on staff, I was given the freedom to redesign the delivery of the Group IV project. The result of my redesign was a return to an open-inquiry, collaborative approach to scientific investigation, including a month of preparation and a two-day, off-site trip to gather data and present findings. In order to facilitate the focus of true field work, supplies were limited to portable hand-held field technology, graph paper, markers, and poster boards. At the end of day two, as the students presented to the teachers and their peers, questions were asked about their process, the challenges, the successes, and what they would change next time. The students’ responses reflected their enjoyment in the process and of feeling like ‘real’ scientists. Even with the challenges and failures, they had a greater understanding and appreciation for how important it is to consider different perspectives rather than just their own ideas and thoughts. The collaborative approach to the Group IV project now focused on inquiry-based learning, with an intentional shift to concentrate on the process rather than the product. This experience, with
open inquiry, created opportunities for students to grow as lifelong learners and critical thinkers. My involvement with this inquiry-based project forever altered my thinking about teaching and learning.

**Historical Foundations of Inquiry**

There is a history dating back to the early 1900s that set the groundwork and visionary thought for creating spaces where students could learn within an active and participatory community. John Dewey advocated for education that connected to students’ lives, highlighting the importance of schools as a place of community, where students would learn through action, and curriculum would be based on students’ interests (Dewey, 1938). Dewey’s philosophy and radical ideas about education were explored and employed in schools around the world. His foundational ideas also shaped emerging early childhood education programs like the Italian Educational project (later known as the Reggio Emilia approach), an inquiry-based learning model (Lindsay, 2015). Dewey’s constructivist ideas, where learners construct their knowledge out of their experiences, placed the teacher in a position of partnership with their students, which is now seen as the foundation of an inquiry approach (Garrison, 1996). In science education, the constructivist framework is the foundation of scientific investigation and inquiry, allowing learners to build knowledge based on prior experience while exploring new concepts.

Inquiry-based approaches to science education have been at the centre of conversations in science education for decades (National Research Council [NRC], 2000). According to the NRC (1996), the definition of scientific inquiry is as follows:

Scientific inquiry refers to the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Inquiry also refers to the activities of students in which they develop knowledge and understanding of
scientific ideas, as well as an understanding of how scientists study the natural world (p. 23).

Although scientific inquiry is defined above, it is important to also identify the term inquiry-based learning, a more general pedagogical approach used across the curriculum. In essence inquiry-based learning is simply a process of wondering, asking a question, seeking understanding, problem-solving and sharing findings (Bray & McClaskey, 2015). For the past 20 years, educational documents such as the *National Science Education Standards* have continually called for the promotion of inquiry-based and student-centred learning in science (NRC, 1996). However, not all research supports inquiry-based approaches in science, some of which cite misconceptions arising from limiting direct instruction (Kirschner, Sweller, & Clark, 2010) and recent studies indicate that these reform-based approaches do not increase science achievement (Cairns & Areepattamannil, 2019). The NRC has had some influences on science curriculum in the United States, however parts of Canada is making strides to large scale changes in curriculum. For example, the current BC science curriculum requires that students have the opportunity to “develop the skills, processes, attitudes, and scientific habits of mind that allow them to pursue their own inquiries using scientific methods” (British Columbia Ministry of Education, 2018, para. 3). The current K-12 BC curriculum was fully implemented in September 2018. At the core of the redesigned BC curriculum is a competency-based approach to learning with the foundation cemented in literacy and numeracy. These recent changes to the BC curriculum, with a focus on inquiry and personalized learning, is leading the way to educational change and new approaches to learning across Canada (Blades, 2019).

Science is the study of the natural world and all that is in it. Carl Sagan (1996) takes this definition one step further and defines science as “more than a body of knowledge; it is a way of
thinking” (p. 25). It is in a child’s nature to be curious and wonder about their surroundings (Bray & McClaskey, 2015). Inquiry based approaches to science connects science education in the classroom and the way in which scientists practice in the community (Riga, Winterbottom, Harris, & Newby, 2017). If classrooms are to be places of wonder and inquiry into the natural world, teachers will need to embrace the curiosity and walk alongside their learners as they explore the world around them. In order to foster an inquiry environment, teachers need to develop knowledge and teaching strategies, and have personal experience within an inquiry process (Steele, Brew, Rees, & Ibrahim-Khan, 2013). In an inquiry environment, students develop skills to perform inquiry, while gaining a deeper understanding of curricular concepts. The goal of teaching science through an inquiry approach is for students to gain a better understanding of the scientist’s world, to be able to formulate questions, to gather observations, to make meaning of those observations, and create arguments supported by the evidence gathered (Crawford, 2007).

Students in a World of Inquiry

Students learning in a teacher-directed traditional model are passive receivers of information -- they are not active participants taking ownership of their learning. Students, suggest Andersen & Garcia-Mila (2017), need to be given the opportunity to engage with materials, ideas and abstract concepts to develop higher order thinking skills, such as critical thinking and problem solving. The inquiry approach makes learning meaningful to students by connecting what they are learning, and their prior knowledge, to their world, and focusing the learning intentions on critical thinking skills. Classrooms that engage in inquiry approaches typically show a higher emphasis on activities that analyze science questions, use evidence for developing explanations, promote peer communication to defend conclusions, and use
investigative methods to develop understanding (Barrow, 2006). In my experience, there is often tension for teachers between a desire to share knowledge with students and an encouragement to grapple with ideas and concepts. If the goal of science education is to educate learners for a world they are heading into, they need to be equipped with the skill of posing critical questions, thinking through a problem, enacting a plan, and reflecting on issues (British Columbia Ministry of Education, 2018). Alfie Kohn (2014), proponent of progressive education, speaks of the need for schooling where teachers embrace collaborative, student-centred and cross-curricular practice. Students need to be given the opportunity to see connections between learning and life, as they do not take place in isolation, for example; there is beauty in the natural world, poetry in rhythm, an understanding of wave theory in music, geometry in basketball, chemistry in ceramics and mathematics in game theory.

**Teachers in a World of Inquiry**

The teacher’s role in a teacher-directed traditional model is that of knowledge holder and disseminator of information. This expert mindset provides little opportunity for teachers to engage areas in which they have less experience. Many teacher candidates within teacher education programs enter their studies having been prepared through their K-12 education with mainly teacher-centred, passive learning models (Lee & Krapfl, 2002). Beliefs about teaching and learning are formed during a student’s formative education (Jones & Leagon, 2014). If teacher candidates are unable to develop effective techniques for teaching reform-based methods such as inquiry during their teacher education program, it can be difficult to adjust those early formed beliefs and conceptions about teaching and learning. (Yilmaz-Tuzun, 2008).

On the other hand, the role of a teacher in an inquiry-based setting is that of a lead learner or facilitator, someone who is skilled at asking probing questions, offering direction and
feedback when needed, and leading students to making meaning and connections out of their
discoveries (Bray & McClaskey, 2015). In order to best experience and understand the nature of
science (NOS), teachers provide inquiry-based learning opportunities in which students can
personally engage and experience a reflective process (Turcotte & Hamel, 2016). Steele, Brew,
Rees, & Ibrahim-Khan (2013) found that the road from teacher-directed instruction to student-
centered learning involves providing opportunities for educators to have their own inquiry-based
experiences. These teacher-inquiry experiences, within a discipline area or a broader context,
have the potential to transform teachers’ practices.

Transformative teaching has been referred to as “the humanistic concept of teaching: the
voyage is underway and we are pilgrims, not tourists” (Ayers, 2004, p. 3). Tourists set out an
itinerary, make observations, go where they are told and absorb their surroundings. Pilgrims,
rather, are on a voyage and invested in the journey. They begin with an idea, purpose or
destination in mind but allow the environment and community to shape and transform their
experience. Teachers, therefore, need to be on a journey -- like pilgrims -- of learning with their
students, not a journey of tourism, but a journey of a pilgrimage.

In the context of teacher education, developing inquiry-based teaching practices of
science education requires a focus on preparing teachers to be lead learners and pilgrims, who
are skilled at asking questions, who employ reflective practice, and who are transformed through
their experience, with a goal of fostering classrooms of curiosity. Building a practice of
reflection, curiosity and inquiry-based approaches is not limited to science, all curricular areas
can benefit from teachers building their practice around student-centered, inquiry approaches.
Teacher education programs therefore need to create opportunities for teacher candidates to
engage personally with inquiry early in their teacher education programs, in order to help shape
and expand their view of teaching and learning (Lee & Krapfl, 2002; Yilmaz-Tuzun, 2008). A requirement of inquiry is allowing enough time to be able to pose questions, explore and reflect so immersing teacher candidates into inquiry early in their programs can provide a supported and collaborative structure for them to build their reflexive and reflective practice.

**Theoretical Framework**

The theoretical framework that guided and shaped this study was constructivism. Constructivists such as Cranton (2013) would say that learners actively engage with information and ideas, creating meaning out of their experience. Learners build on prior experiences that is meshed together with new information gathered during new experiences to form and construct their understanding and gained knowledge. As an educator, my belief is framed around constructivist theory suggesting that knowledge is gained through lived experience and is affected, informed and shaped by the experience itself; this influences my view of what effective teaching and learning looks like.

Theorists such as Piaget, Dewey, Vygotsky and Bruner have contributed to constructivist and social constructivist theory, building upon and influencing one another’s work over the past century (Glassman, 2001; Lindsay, 2015). Vygotsky’s theory of Zone of Proximal Development (ZPD) defines where learning (and inquiry) takes place, between what is known and what is not known (Bray & McClaskey, 2015). But Vygotsky’s work is heavily influenced and identifies social interaction and historical context as significant in the learning process (Glassman, 2001). As I look at my study, where I explored the lived-experience of teacher candidates through an inquiry and within the classroom, the participants began the study with many past experiences, varied academic backgrounds, and a diverse social and historical context. Vygotsky’s view would
suggest that this varied history and their social interactions within their teacher education program would influence their learning and development as teachers (Glassman, 2001).

**Role of the Researcher**

I am a teacher educator in the teacher education program where the research was carried out and work with or have worked with all of the participants in the study. I bring with me a deep understanding of the inquiry project structure the study was built around, as I work with the teacher candidates during their inquiry experience and with our school district field partners, with whom I have forged a collaborative relationship. However, it is critical to recognize the potential of bias and my interest in the continued professional partnership between the university and the field. Therefore, throughout the study I needed to continue to ensure I was aware of my position as the researcher and took steps within the design of the study to minimize the potential for bias. For example, the recruitment for the study was done through a third party. It was important to consider both my position and my positionality, the constructivist lens in which I see the world and how these perspectives influenced the design of the study, the collection and treatment of the data, and the resulting analysis. In order to maintain my role as researcher I regularly considered identified ethical considerations, ensured those who were currently enrolled in the program were not identifiable, recorded notes on the research process itself, and reflected on my dual roles as researcher and teacher educator, through the use of journal writing and conversations with colleagues.

The goal of this study was to capture and examine a teacher candidate’s lived experience through of an immersive professional inquiry project. The study aims to uncover the influence, if any, personal experience with inquiry has on a developing teacher’s potential to employ an inquiry approach in their teaching practice. The research question appears at the end of the
literature review, however, the questions driving the focus of the study and the literature review were:

a) What is the teacher candidate’s lived experience through an inquiry project?

b) Following an inquiry experience, is there a change in the participants’ disposition towards inquiry?

c) Does a personal experience with inquiry effect a teacher candidate’s understanding of teaching and learning?

d) As teacher candidates move into the classroom, how has the inquiry experience shaped their outlook on incorporating inquiry approaches to learning?

e) What is the live experience by new teachers, who are implementing inquiry approaches into their teaching practice?

Chapter 2: Literature Review

In the literature review I have included research focused on inquiry, science education, teacher candidates and teachers. I included research examining why, according to the literature, teacher candidates struggle to employ an inquiry approach to science in the classroom, and literature examining the strategies and programmatic efforts that have resulted. The literature identifies five key areas that affect a teacher candidate’s (and teachers) ability to employ inquiry approaches into their practice: a) understanding inquiry (Fazio, Melville, & Bartley, 2010); b) beliefs about teaching and learning (Steele et al., 2013); c) confidence with science content (Rees, Pardo, & Parker, 2013); d) implementation of inquiry (Capps & Crawford, 2013a); and e) professional learning and partnership strategies (Morrison, 2014). The five categories and literature found within the themes have been detailed in this section. I have noted the minimal focus on immersing teacher candidates into inquiry learning at the beginning stages of their
teacher education relative to other research about their experience with inquiry approaches in practicum or beginning stages of practice. I have also noted the limited work centering around the beliefs, epistemological stance and lived experience of teacher candidates from within a personal experience of open inquiry and the transfer of that experience into the classroom. It is this gap to which I aim to contribute.

**Understanding of Inquiry**

A first of the five areas that emerged in the research as a significant area of concern that affects teachers, teacher candidates and teacher educators was the identification and definition of inquiry, what it looks like and its different levels of structure (Capps & Crawford, 2013a; Lustick, 2009; Morrison, 2013). Open inquiry is defined as inquiry which is directed by the student, and the question to be explored is developed by the student and not the teacher (Windschitl, 2003). Although teachers reported engaging students in an open inquiry process in their classrooms, upon investigation these situations were typically initiated by the teacher, not the students, and would be classified as structured or guided inquiry (Lustick, 2009). In Lustick’s study (2009), secondary science teachers, who were embedded in an inquiry experience, experienced an increase in their belief that inquiry approaches are inefficient and can lead to incorrect conclusions about new content. The comments and experiences found in some of the research highlights a lack of understanding of not only the definition of inquiry, but also of the overall purpose of inquiry itself (Crawford, 2007; Lustick, 2009; Morrison, 2013).

True inquiry differs from hands-on activities, in that, hands-on activities engage students through performing a lab experiment, interacting with and using various equipment, or creating a physical representation of a theory or model; however, in order to reach the purpose of inquiry there needs to be the additional step of using the activity or exploration to build understanding
(Fazio et al., 2010). Slavin, Lake, Hanley & Thurston (2014) measured pre-test and post-test results of two groups of students, those using an inquiry based approach to problem solving and those using hands-on kits. The post-test results from the two groups indicate that an inquiry approach deepened students’ understanding of science concepts and although kits offered a hands-on experience, they did not have a positive impact on increased understanding (Slavin et al., 2014).

**Beliefs about Teaching and Learning**

The second area I explored to support my research is the concept and construct of belief in relation to teachers’ understanding of teaching and learning. In a study investigating changes in beliefs of teacher candidates through inquiry activities, Pilitsis & Duncan (2012) found that teacher candidates’ beliefs shifted to a student-centered focus in relation to teaching, although when they experienced challenges, there was a tendency to revert back to teacher-directed desires of content delivery. Teacher candidates’ formation of constructivist ideas around teaching and learning were evident, particularly with those who had prior inquiry experience (Melville, Fazio, Bartley, & Jones, 2008). In several studies, it was noted how quickly new educators became discouraged with new inquiry strategies, static in their beliefs, and unwilling (or unable) to change (Carrier, Tugurian, & Thomson, 2013; Melville et al., 2008; Pilitsis & Duncan, 2012). According to Kohn (2014), “There are few barriers to change as intractable as the belief that one doesn’t need to change” (Kohn, 2014, p. 1).

My research study takes place in a Canadian university within the province of BC, where recent changes to the curriculum have been implemented over the last four years (British Columbia Ministry of Education, 2018). Some of the significant changes to the curriculum include; a move towards a competency based approach to teaching and learning, a focus on
literacy and numeracy from K-12, a personalized learning model, and an imbedding of the First People’s Principles of Learning across the curriculum (British Columbia Ministry of Education, 2018). In the new BC curriculum, educators are being encouraged to employ an inquiry-based approach and student-centred learning in order to delve deeper into questions, expand understanding and explore larger cross curricular concepts (British Columbia Ministry of Education, 2018). This is far from a simple change. In order to change one’s practice, a teacher needs to look critically at, and reflect on their classroom learning environment as well as their beliefs and philosophy. Many teachers, suggest Capps & Crawford (2013a), have found success with certain approaches, including traditional, teacher-directed instruction, which some will define as the goal for what successful teaching looks like. Reflecting on one’s practice is not easy, as it requires a willingness to acknowledge a potential need for change. Simply changing the curriculum focus in education will not change what is happening in classrooms (Bray & McClaskey, 2015), unless there is a change in a teacher’s disposition towards a student-centered, inquiry-based approach to learning.

**Teacher Candidate Confidence with Science Content**

The third area affecting a teacher candidate’s ability to employ inquiry approaches in the classroom is their confidence with science content. The literature shows a connection between a teacher candidate’s comfort and confidence with science content and their disposition towards reform-based practices such as inquiry (Steele et al., 2013). Focusing on science education, the level of confidence with curricular content appears to be connected to a teacher’s eventual teaching practice. Pilitsis and Duncan (2012) found connection between a low level of confidence with content and a negative experience with inquiry strategies, which led to teacher candidates hesitating to re-engage with inquiry approaches. Instructors in teacher education
programs often reflect how to best prepare teacher candidates to teach their discipline, such as science or math (Steele et al., 2013). Emerging educators have been found at varying stages of comfort and confidence in teaching science, which is compounded further by most elementary educators having a lack of experience with science content and scientific approach (Rees et al., 2013; Slavin et al., 2014; Steele et al., 2013). Presently, new elementary teachers are lacking in knowledge of basic science concepts and their primary instinct, as a result, is to teach science in the way they learned themselves, which is typically a traditional teacher-directed lecture style (Rees et al., 2013).

A teacher candidate’s level of comfort with teaching science and their belief that it should be taught via traditional methods has been shown to inhibit the uptake of inquiry in their subsequent practice (Rees et al., 2013). In a study investigating teacher candidates’ use of inquiry, participants held bachelor’s degrees in science, yet stated they were unaware of the concept of NOS, and related the learning of science with facts (Lotter, Singer, & Godley, 2009). This lends support to the interpretation that even new teachers coming into the field comfortable with science content still require a shift in thinking to see science as a questioning or inquiry-based discipline and not the delivery of facts and content. The greatest influences on a teacher’s approach to teaching science are their beliefs (personal and pedagogical), and their own experience of science through their K-12 education (Carrier et al., 2013; Hsu, Reis, & Monarrez, 2017; Lee & Krapfl, 2002; Yilmaz-Tuzun, 2008). If the goal for a teacher is to create a classroom fostering inquiry and student-driven learning, teacher education programs will need to look at the changes required to a teacher’s early education in order to facilitate a shift from traditional delivery methods to inquiry-based approaches.
Implementation of Inquiry

Several studies have looked at teachers and their implementation process to move towards an inquiry approach. Research highlights the positive effects of personal engagement in inquiry and links positive past science experiences with an openness to inquiry (Capps & Crawford, 2013a; Morrison, 2013). Capps & Crawford (2013b) looked at the relationship between teachers’ views and their practice and found that those who held constructivist views made an easier transition to incorporation of inquiry approaches. A significant contributor to a teacher candidate’s success of implementing inquiry approaches was found through the scaffolding of both a candidate’s inquiry experience as well as strategies to scaffold inquiry with students (Melville, Bartley, & Fazio, 2013; Rees et al., 2013). Much of the research also identified key factors that have hindered a teacher’s ability to embrace an inquiry approach, such as a lack of knowledge of NOS (Capps & Crawford, 2013a), lack of personal experience with inquiry (Morrison, 2013), beliefs about learning and disposition towards inquiry (Rees et al., 2013), and time constraints and curriculum expectations (Melville et al., 2008). A teacher education program could significantly impact the developing practice of new teachers by immersing teacher candidates in an inquiry experience, with the aim of expanding their epistemology and building their reflective practice.

Teacher candidates entering the field need to have personal experience with inquiry in order to develop the skills to facilitate student inquiry (Melville et al., 2013). Students and teachers need time, guidance and feedback built into an inquiry process in order to successfully engage in the reflective practice of inquiry (Lotter et al., 2009). Scaffolding allows for learning to take place with guided reflective questions and the opportunity for practice and theory to construct understanding. Scaffolding inquiry has been found to be effective in leading teacher
candidates through an inquiry process themselves, when the structure moved in phases from a
teacher-directed question and methods to students deriving all aspects on their own (Melville et al., 2013). Rees et al (2013) also found scaffolding an effective approach for teacher candidates
to set up and support an environment of inquiry in a classroom with students.

The kit or “cookbook” approach, which provides a detailed procedure for students to
follow, is common in science classrooms for two reasons. First, it offers a guide to the educator, who may or may not have an extensive background in science and therefore might not be comfortable developing a hands-on experiment. Second, it offers a “real” experience, designed
to give students a practical, fun and interactive format for learning (Somyürek, 2014). Capps and
Crawford (2013a) found that teachers who used a kit approach struggled to implement inquiry
strategies in a science classroom, as they focused on skills and conditions they felt were needed
to do inquiry rather than having an actual understanding of the purpose of inquiry. In a study
completed by Crawford (2007), she found that a teacher candidate’s ability to implement inquiry
was further hindered by their personal beliefs about teaching and their disposition towards
reform-based practices, such as inquiry, even if teaching strategies were scaffolded into their
practice. Crawford’s research also focused on partnering teacher candidates with practicing
teachers and investigated the influence of field partnerships/mentorships.

Professional Learning and Partnering Strategies in Inquiry

Researchers have explored several strategies concerning the implementation of inquiry by
pre-service and in-service teachers. An area within the literature highlights the important
partnership that exists between emerging educators and those currently in practice. In an in-depth
study looking at the field placement experience of pre-service teachers implementing inquiry
approaches, the mentor teacher/practicum candidate partnership was examined, suggesting that a
mentor’s disposition and openness to inquiry had an influence on the pre-service teacher’s willingness to experiment with inquiry approaches (Crawford, 2007). Research indicates that inquiry allows learners to engage and connect to a subject as more than something to study at school, because they were directing their own learning (Meyer & Crawford, 2015). This evidence speaks to the need for continued reform in teacher education programs to shift with emerging practices and curriculum change. Professional learning opportunities through inquiry-based models are needed for pre-service and in-service teachers to engage and immerse themselves in inquiry.

The research with practicing teachers has focused on professional development strategies to experience inquiry and build skills around inquiry approaches. Successful experiences with inquiry are described in the literature; in a study conducted by Lotter, Yow and Petters (2014), teachers were paired with another colleague who had professional coaching experience to engage in an inquiry experience through a two-week course outside their classroom setting. Collaborative professional reflection was found to be a major contributor in furthering a teacher’s growth in the area of inquiry (Lotter et al., 2014). Morrison (2014) conducted a similar study, which paired teachers with scientists to explore an inquiry model situated outside of a classroom setting. Through this experience, the teachers’ understanding and views of inquiry improved and the participants reported they were able to implement inquiry in their classrooms subsequent to the professional development opportunity (Morrison, 2014). The use of partnerships with educators and reflective practice with teacher candidates utilizing an inquiry approach, have emerged as areas that should continue to be explored further.

Inquiry-based pedagogy is used in other areas of curriculum as well. For example within an in-depth research review Dobber, Zwart, Tanis and van Oers (2017) looked at inquiry based
education, which curricular areas it is being used and the role of the teacher within various contexts. Three main areas of reform-based pedagogy are evident and explored within the literature; inquiry-based learning, problem-based learning and project-based learning. The majority of science inquiry was found to be conducted through experimentation, but inquiry within language arts, social studies and cross curricular contexts was found to be based on research and observation into a problem or situation and in some cases involved design aspects (Dobber et al., 2017). Aspects of the role of the teacher, student and teacher understanding of inquiry, and challenges to implementation are echoed through the literature regardless of the curricular area in which inquiry-based approaches are begin explored (Anderson, 2002; Black, 2004; Dobber et al., 2017; Morrison, 2013; Windschitl, 2003).

In summary, I have drawn on five areas in teacher education literature that appear to have an effect on teacher candidates, their teaching practices and their use of inquiry approaches. Three of the categories identify challenges or barriers to teacher candidates’ implementation of an inquiry approach -- their understanding of inquiry, their beliefs about teaching and learning, and their confidence in science content. The final two categories, implementation of inquiry and professional learning strategies, highlight within the literature both successful and unsuccessful strategies to incorporate reform-based practices such as inquiry into a teacher candidate’s teaching practice. To be effective at influencing a teacher candidate’s understanding and use of inquiry, the literature suggests early experiences with inquiry, coupled with an opportunity to upset prior beliefs about teaching and learning, is required. My research aims to shed light on a teacher candidate’s experience through an open inquiry project, the effect that experience has on their understanding of teaching and learning, and how the experience influences their eventual teaching practice.
Research Question

Teacher candidates need professional learning opportunities to take risks, think creatively and engage in an inquiry approach as learners themselves (Melville et al., 2013). In order to facilitate lasting change in teaching practice to a student-centered, inquiry-based learning model, one requirement will be a change in a teacher’s disposition towards inquiry (Yilmaz-Tuzun, 2008). It is out of a desire to seek clarity and insight into the lived experience of teacher candidates who engage in an immersive professional inquiry process in their pre-service education, and the transfer of that process into their teaching practice, that I will endeavor to study the following research question: What is the effect on a teacher candidate’s likelihood to employ an inquiry approach to science in their classroom following their own participation in an open-inquiry process during their teacher education? A sub-question I will explore is: How does participation in an inquiry process influence a developing teacher’s understanding of teaching and learning?

Chapter 3: Methodology

A qualitative methodology, using a nested case study approach, was used to explore the research question(s), guided by a critically-reflective research epistemology and practice. The critically-reflective stance is one that considers both the breadth and depth of reflection, while also critically looking at the connection between the two (Chadderton & Torrance, 2011). Thompson and Pascal (2012) describe this breadth as widening our sociological lens and this depth as understanding our assumptions, feelings and values within a complex situation, such as teaching in a classroom. In this study participants were required to critically reflect on an inquiry experience, face their assumptions, notice and name that which they valued, and consider the lens with which they view their context and their practice.
A Nested Case Study

A nested case study is a modification on the case study approach, as it identifies one event, but tracks the effect of the identified event on two or more individuals or groups, rather than a single group or participant. This nested case study was designed to capture teacher candidates’ experiences of an open inquiry project and the effect of that experience on their eventual teaching practice. Three groups of participants at different phases of their practice were involved in this study, giving rise to the ‘nested’ design. This nested case study approach also allowed me to define the boundaries of the study, which was framed around the teacher candidates experiencing an inquiry project. The approach permitted various methods to gather deep descriptions and the lived experience of the participants through surveys and interviews. The intervention used as the basis of this case study was the participants’ involvement in the open teacher inquiry process and the influence of that experience on their approach to teaching and learning.

Case study is a highly utilized methodology within educational research although it is not easily packaged into one design. Chadderton and Torrance (2011) describe case study as an approach which tries to examine the complexity of a situation and consider what the people bring to the context. Evidence can be gathered through the use of interviews, focus groups, document analysis, observations and surveys (Chadderton & Torrance, 2011; Yin, 1994). Case study was the best approach to answer my research questions as the goal of my research was to capture how the inquiry experience impacted both the participant and their practice, where I had little control over the ‘case’ event, and the focus of the study was a current situation with real-life context. These three criteria were best served through a case study approach (Yin, 1994). Educational case studies often draw on an ethnographic rationale with a goal to gathering thick descriptions.
of the lived experience of the participants where the researcher chooses depth over breadth and focuses on the narrative first then seeks to offer explanation (Chadderton & Torrance, 2011). Case study seeks to answer the ‘how’ or ‘why’ side of a research question, which is why case study was the best choice for this research.

A case study methodology does not come without its criticisms, citing limited sample size and potential for bias, accusations of weak research design with a lack of rigor, and resulting in non-generalizable findings (Gerring, 2006). These arguments are countered by other scholars in the field noting the importance of first considering the research question and the purpose of the research itself before choosing case study as the approach. One of the major criticisms of case study is that the results are not generalizable but Yin (1994) argues the goal of case study is not for findings to be applied to another case but for the researcher to generalize the findings to a theory and therefore providing external validity. As one’s teaching practice is very individual and highly contextualized, it may be more appropriate to apply findings from research based in a particular teaching context to a theory as opposed to another case or teacher.

**Context and Participants**

This study was carried out with teacher candidates enrolled in a 16-month Bachelor of Education Post Degree Professional (PDP) Program in Elementary Curriculum at the University of Victoria on the west coast on BC, Canada. Three groups were used to gather data of the teacher candidates’ experiences: Group 1) Teacher candidates who are approximately seven months into their studies; Group 2) Newly graduated teacher candidates, three months after completing the PDP program; and Group 3) Practicing teachers with up to one year of experience, who completed the PDP program one year prior to the study. The candidates within the program fell between the ages of 22 and 50. The University of Victoria PDP Program
typically contains 20-30% male and 70-80% female. There was no other selection process used for inclusion in the study. Figure 1 shows the research timeline relative to the participants progress through the inquiry project, the teacher education program, and into their career.

Figure 1. Timeline of research. The graph shows the timing of the research relative to the participants progress in program and into their teaching career. 0 represents September 2016, when Group 3 enters the program, and 31 represents March 2019 when data was collected on all three groups.

As part of the PDP Program, candidates were enrolled in a seminar course which embedded them into classrooms once a week, at the beginning of their program, for twelve weeks. During this time candidates were partnered with practicing teachers to engage with learners in a classroom environment. Teacher candidates experienced an open inquiry process throughout the entire term. Candidates developed a question around an area of education and teaching that they wanted to explore more deeply. The seminar instructors and partnering educators coached by asking probing questions about their inquiry, designed to build reflection into their process. Teacher candidates presented their findings of their inquiry in a poster
presentation style conference to their instructors, partnering educators, teacher candidate colleagues, as well as various university faculty and school district staff. The inquiry project was a required assignment within seminar course in the PDP Program, which all teacher candidates complete. The purpose of this study was to capture the lived experience within the inquiry process outlined above and the effect that experience had on the teacher candidates’ mindset and disposition towards inquiry. Although this was not an ethnographic study, I needed to consider the schooling culture from which the participants came, and its effect on their views of learning and their practice as beginning teachers. The target groups for the study were chosen based on their experience with an inquiry project while enrolled in their 16-month Post Degree Professional (PDP) Program and their varying phases of teacher development (see Figure 1).

Group 1 consisted of teacher candidates currently in the program, who were at a critical phase of developing their teacher identity and exploring many techniques and approaches to teaching and learning, some of which may have been very different than their own personal background of education (Crawford, 2014; Windschitl, Thompson, & Braaten, 2008). They had not had a practicum experience yet, however an experience working with a practicing teacher and students in a classroom enabled them to begin to build their skills and strategies of their practice. During the first four months of their program, they were embedded into classrooms in an active observer role while completing the inquiry project. This allowed the teacher candidates to be engaged in classrooms while exploring their inquiry question they developed, connecting with educators, and examining how their inquiry question fit into the context of the classroom.

Group 2 consisted of teacher candidates who had just completed their program, participated in two practicum experiences as part of a very intense 16-month program, of which they participated in the inquiry project 12 months prior to the study. They explored different
facets of teaching and learning and had the opportunity to try many teaching strategies in classrooms. They had recent full-time classroom experience working with practicing teachers and were able to offer insights into their thinking about an inquiry approach to teaching and learning in the classroom.

Group 3 consisted of participants who had completed the program one year prior to the study. These now certified teachers had up to one year of teaching experience, time to reflect on their own experience through their personal inquiry, and may have been able to make links between their experience and their practice of inquiry (if present) and any challenges to using an inquiry approach. Figure 1 shows the progress of each group from the beginning stages of their teacher education program where they experience the inquiry project to practicing in the classroom, as well as the connection in timing between all three groups.

Methods of Data Collection

The goal of the research was to gather information about the teacher candidates’ experience through an inquiry project, how that project affected their thinking about teaching and learning, and their experience of inquiry in their current practice. In order to capture this information, survey and interview methods were chosen for data collection and carried out in March and April 2019 (see Figure 1). The survey was developed around a series of questions about the participants’ experience within and following their inquiry project, their understanding of inquiry, and their use of inquiry approaches. The survey was pre-tested with 3 faculty members and then tested on a group of teachers in a research methodology graduate course, prior to data collection. The survey was designed to guide participants through a reflective exercise by asking questions related to their experience within as well as after the inquiry project. Participants needed to recall their experience, feelings and values throughout the process. For
those in Groups 2 and 3, further questions were used to gather demographic information, details of their current teaching practices and their overall thoughts about the influences on their practice. The interview process used a semi-structured method designed to have participants reflect deeply on their lived experience through inquiry in the program and in their practice. These two methods allowed for the creation of a fulsome picture of their experience and provided an understanding of their trials and triumphs in inquiry.

**Surveys.** One of the methods used for data collection in this research was a survey. Surveys were sent out to the three target participant groups, based on entry point into the Teacher Education Program (TEP), defined previously as Groups 1, 2 and 3. The purpose was to capture the data during the same time frame, but with three different groups who were at varying stages of their teaching practice: teacher candidates (Group 1), newly certified teachers (Group 2) and those with up to one year of experience (Group 3). The online survey was designed to take approximately ten minutes to complete, responses were anonymous and participation voluntary. The mechanism used for the online survey was Survey Monkey through the University of Victoria platform (https://www.uvic.ca/systems/support/web/surveymonkey/index.php). The survey questions were a mix of multiple-choice format, ranked statements with a Likert scale, and open-ended response format. The ranked statements were designed to elicit information about the participants’ experience during and after the inquiry project, as well as within their teaching practice. The open responses allowed for thoughtful reflection and prompted participants to contemplate their held values about teaching and learning. See Appendix B for a full outline of the survey questions used for the study. The desired number of participants for the survey portion of the study was 10 from each group (approximately 30% of the cohort) and a
total of 3-4 interview participants. These two data collection methods allowed for a rich mix of quantitative and qualitative evidence.

**Interviews.** The second method used in this research was interviews. Interviews are widely used in case study research as they provide a platform for gathering thick descriptions to paint a picture of a particular situation or event (Chadderton & Torrance, 2011). There are three general types of interviews; open, semi-structured, and structured. As the style moves from open to structured, the interview becomes much more driven by a pre-determined set of questions and less likely to be driven by the interviewees focus or experience (Yin, 1994). There are several considerations when using interviews as part of the research methods including unpredictable outcomes, ethical concerns, hidden agendas, power, trust, and truth (Barbour & Schostak, 2011). However, the nature of a case study seeks to answer the question ‘how’ or ‘why’ of complex issues and in doing so the researcher needs to embrace methods such as interviews that might be messy in order to uncover a fuller picture of the issue being researched. As I was seeking depth of understanding of a complex context like teaching, with participants in a vulnerable position as they reflect on their own practice in a new role, an interview approach provided the best opportunity for participants to explore and reflect on their thoughts, values, experiences, and beliefs about inquiry.

The aim of the interviews for this study was to capture the essence of the lived experience during and following the inquiry project. More importantly, the interviews allowed me to collect data on the mindset of these new teachers relating to inquiry and the influence that personal participation in inquiry had on the implementation of inquiry approaches into their practice. The interview was semi-structured, with the ability for participants to explore and reflect on their past
experience throughout the inquiry process, their experience with inquiry in practicum situations, as well as new teaching experience since being certified to practice.

Teaching is a multi-faceted and complex environment. I recognize that any time a teacher is asked about their practice, especially those new to their practice, it can be a vulnerable position. During the interview process, it was important to ensure participants knew that there would be no repercussions or judgement based on a participant’s ability to engage in an inquiry process or their ability to implement inquiry strategies in the classroom or how they valued the inquiry process. The study aimed to identify whether or not participation in an inquiry experience had an effect on teaching practice and approach to teaching and/or learning. Participants were given the opportunity to reflect on their own epistemology and their beliefs about teaching and learning. This time of reflection also served to provide professional development as it allowed them to articulate their thoughts about inquiry, identify their own experience through an inquiry process, explain how inquiry was (or was not) part of their practice, and provided them the opportunity to share their experience from the classroom. The set of open-ended questions used for the semi structured interview can be found in Appendix C.

Data

Recruitment of participants. After the completion of the fall 2018 term in which the inquiry project took place, current and past teacher candidates were invited to participate in the study. The target groups for this study were those enrolled in or recently graduated from the 16-month Elementary Post Degree Professional Program at a university in British Columbia. As I work within the teacher education program in which the participants were enrolled, an invitation to participate in an anonymous online survey was sent out by a third party, the Teacher Education Office assistant, to ensure there was no coercion to participate. Upon submitting their survey
answers, the participants who had graduated from the program were offered the opportunity to participate in an interview. Participation in the study was voluntary and no remuneration was provided. As the survey was anonymously completed online, I had no ability to connect the survey responses to participants. The total number of participants in the study was 26 teacher candidates/teachers who completed the survey, three of which elected to continue their participation into the interview phase of the study. There were 30 sources of data to be analyzed including 26 survey responses, one survey summary document and three interview transcripts.

**Analysis.** The data was collected from the surveys and interviews over a two-month period. The information and data gathered included group summary documents from the online survey, individual responses to the survey questions, and three audio recordings. Following two listenings of each recording, I manually transcribed the interviews to word documents. The survey questions were coded and analyzed for patterns within the whole groups as well as within the cohort Groups 1, 2, and 3. I also looked for whether or not patterns occurred as a result of an earlier answer to a question. For example, did a strong agree/agree ranking for a particular question correspond to a particular answer in another question? To analyze the interview data, I used thematic analysis. Thematic analysis is a process used to make meaning out of qualitative data by noticing and examining patterns (Clarke & Braun, 2017; Guest, MacQueen, & Namey, 2012). Each transcript was first colour-coded based on the general interview questions, then comments were further divided into categories that emerged within each question. Themes and patterns were identified within each individual interview, as well as across the three interviews. The data was also scrutinized for connections between the survey data and the interview data.

In order to ensure validity and trustworthiness of the data, several steps were taken during both the data collection phase as well as the analysis phase of the collected data from both the
survey and interview portions of the study. During the design phase of the survey questions, the
questions were pre-tested on a variety of individuals, those who are connected to teacher
education, as well as individuals outside of the faculty and university setting, to confirm
questions did not contain jargon or potentially confusing wording. Feedback was incorporated
from several sources and then tested on a group of graduate students following a brief
presentation of the context of the research. During the interviews, as the goal was to capture the
teachers’ lived experience, they were given the freedom to reflect on and share stories they felt
stood out in their own practice, in order to limit bias and potential of steering the interview in a
particular direction. Finally, once the transcripts were completed and the findings section was
written, each participant’s “story” was sent for confirmation of an accurate reflection of the
interview ensuring trustworthiness of the qualitative data and the representation of their
experience.

Chapter 4: Findings

In this chapter, I will present the quantitative and qualitative findings from the study,
including survey results and interviews. This chapter is divided into sub-headings to provide an
outline of the examined data leading to the research questions: 1) What is the effect on a teacher
candidate’s likelihood to employ an inquiry approach to science in their classroom following
their own participation in an open-inquiry process during their teacher education? 2) How does
participation in an inquiry process influence a developing teacher’s understanding of teaching
and learning? An overview of the survey participants is provided and a description of the
demographics of the interview participants shared. The overall survey results are given and have
been broken down into three groups based on the year of entry into the teacher education
program: Group 1 -- entry point 2018 and still in program; Group 2 -- entry point 2017 and
recently certified; and Group 3 -- entry point 2016, certified teachers and practicing for up to one year. The results of each interview will be presented separately first, followed by the observed intersection between the interviews and overarching categories that emerged.

**Participant Demographics**

Respondents to the survey were from all three groups with total cohort numbers ranging from 4-11 participants per group. Three participants were interviewed and each interview was approximately one hour in duration. The group size and interview participant demographics are listed below in Table 1. Note that pseudonyms have been used and school names removed to ensure confidentiality.

Table 1

*Summary of participants and demographics.*

<table>
<thead>
<tr>
<th>Group/Participant</th>
<th>Demographic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Survey</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11 respondents out of a cohort of 45, entered TEP September 2018</td>
</tr>
<tr>
<td>2</td>
<td>4 respondents out of a cohort of 32, entered TEP September 2017</td>
</tr>
<tr>
<td>3</td>
<td>8 respondents out of a cohort of 33, entered TEP September 2016</td>
</tr>
<tr>
<td>All</td>
<td>26 respondents in total, 23 respondents were categorized into groups 1-3 based on entry date to TEP, 3 respondents left the survey within the first 2 questions before completing the question on entry date to the TEP</td>
</tr>
<tr>
<td><strong>Interview</strong></td>
<td></td>
</tr>
<tr>
<td>Tara*</td>
<td>Interview time was 1:16:57, from Group 3, entered TEP September 2016, participated in professional inquiry in Fall 2016, graduated Fall 2017, has been teaching for just over one year, is working full time, with elementary students, between two contracts at rural, public schools</td>
</tr>
<tr>
<td>Janet*</td>
<td>Interview time was 51:41, from Group 3, entered TEP September 2016, participated in professional inquiry in Fall 2016, graduated Fall 2017, has been teaching for just over one year, is working full time, with elementary students between two contracts at urban, public schools</td>
</tr>
<tr>
<td>Joan*</td>
<td>Interview time was 1:17:07, from Group 3, entered TEP September 2016, participated in professional inquiry in Fall 2016, graduated Fall 2017, has been teaching for just over one year, is working full time, with middle school students, at an independent school in an urban centre</td>
</tr>
</tbody>
</table>

* note pseudonym used
Overall Survey Results

The survey results were collected over a 30-day period and included a total of 26 respondents, 23 of which were identified as belonging to one of the three study groups. Three of the respondents left the survey within the first three questions, allowing me to use their responses from the beginning questions; however, the data cannot be linked or analyzed within a given group. Of the 110 invitations to participate, there was a response rate of 24%. All participants have a prior degree and the three most common undergraduate degrees indicated in the survey were: 35% humanities, 26% social and behavioural sciences, and 17% science. The survey indicates 62% of the participants had no prior experience with inquiry before their teacher education program, either through their K-12 schooling or any post-secondary education. For those who had experienced an inquiry environment, the majority (60%) felt it allowed them to pursue an area of interest.

One of the goals of the survey was to give participants an opportunity to express their individual experience during and after the professional inquiry project, the majority of whom would have experienced inquiry learning for the first time. The survey was set and interpreted in six sections. Since the question I was addressing was the effect on a teacher candidate’s likelihood to employ an inquiry approach to science in their classroom following their own participation in an open-inquiry process, I decided to present the findings from the survey in the next six sections under the following headings: 1) Identification of participants working in the field and using inquiry; 2) Level of comfort through inquiry; 3) Significant learning; 4) Context where inquiry is being used; 5) Change through the inquiry experience; and 6) Teacher candidate understanding of inquiry. I begin by presenting a summary of the responses based on the teacher candidates’ experience during and after their participation in the inquiry project; these responses
are provided in Table 2. In the survey, ranked questions used a 5-point Likert scale (strongly agree, agree, neutral, disagree, and strongly disagree). For the purpose of viewing trends, responses that were answered with agree or strongly agree were grouped together to indicate a “positive response” to the given survey questions identified in Table 2. Percentage rather than total number of responses was used within Table 2 to be able to compare the three groups to one another as well as view the trends as a whole group. It is also important to note that as group 2 included only 4 participants, the total numbers were used to calculate the percentages in the final column in order to minimize skewed data.

Table 2

*Breakdown of positive responses to survey questions on the inquiry project.*

<table>
<thead>
<tr>
<th>Statement</th>
<th>2018</th>
<th>2017</th>
<th>2016</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>During the inquiry project, participants were:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excited to pursue an area of interest</td>
<td>100</td>
<td>75</td>
<td>63</td>
<td>76</td>
</tr>
<tr>
<td>Overwhelmed with getting started</td>
<td>82</td>
<td>100</td>
<td>63</td>
<td>76</td>
</tr>
<tr>
<td>Grateful to connect with other educators</td>
<td>64</td>
<td>75</td>
<td>63</td>
<td>64</td>
</tr>
<tr>
<td>Uncomfortable with openness of inquiry</td>
<td>64</td>
<td>25</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Uncertain when finished</td>
<td>64</td>
<td>50</td>
<td>50</td>
<td>56</td>
</tr>
<tr>
<td>Enjoying the process</td>
<td>73</td>
<td>25</td>
<td>50</td>
<td>52</td>
</tr>
<tr>
<td>Frustrated by the process</td>
<td>64</td>
<td>25</td>
<td>38</td>
<td>52</td>
</tr>
<tr>
<td><strong>After the inquiry project, participants were:</strong></td>
<td></td>
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<tr>
<td>Confident to take on personal inquiry</td>
<td>64</td>
<td>75</td>
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<td>63</td>
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<td>Encouraged to try inquiry with students</td>
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<td>100</td>
<td>63</td>
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<tr>
<td>Seeing value with inquiry for humanities</td>
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<tr>
<td>Uncomfortable with inquiry</td>
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<tr>
<td>Uncertain how to use inquiry in a classroom setting</td>
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<td>0</td>
<td>38</td>
<td>21</td>
</tr>
</tbody>
</table>

*Note: Numbers are reported in percentage.*

**Identification of participants working in the field and using inquiry.** The survey was designed to be answered by teacher candidates and teachers from all three groups. As this was a nested case study, the goal was to obtain responses from all participants concerning their inquiry process over the past three years. The final five questions of the survey were only open to participants who identified themselves as belonging to Group 2 or 3 (entry point 2017 or 2016).
The latter part of the survey was designed to capture information about participants who were now practicing teachers and how inquiry has found its way into their practice. Figure 2 provides a visual representation of the group composition of the study depicting entry point to the teacher education program, work history since completing the program and their reported usage of inquiry in the classroom. Group 2 and 3 contain 46% of the study’s participants, and of that portion of participants 33% report working full time and another 51% hold a combination of part time and teacher-on-call (TOC) contracts. When asked if they had used an inquiry approach to learning, 58% of participants reported they used inquiry in their teaching practice.

**Figure 2.** Participants’ entry year to Teacher Education, work history and inquiry usage.

**Level of comfort through inquiry.** Since my research question was: What is the effect on a teacher candidate’s likelihood to employ an inquiry approach to science in their classroom following an open-inquiry project, I was interested in the extent to which teacher candidates became more comfortable with an inquiry approach following a personal experience with an inquiry project, given that the literature points to confidence as an area that can affect implementation of inquiries strategies (Steele et al., 2013). The majority of responses to
statements concerning participants experience during and after the inquiry were either positive (see Table 2) or negative, with relatively low numbers (8-12%) choosing the neutral option. This pattern in the data indicates respondents had strong feelings or opinions one way or the other. In one particular case however, there was a significant change to the number of participants choosing the neutral option. When asked about their comfort with an inquiry approach to learning subsequent to participating in inquiry, 12% changed their stance from a neutral position and there was a 14% increase in participants feeling comfortable with an inquiry approach following their experience (see Figure 3). Although there is no significant change from those feeling uncomfortable to comfortable, and only a 2% decrease in those expressing discomfort, there was a noticeable shift for those who were uncertain during their inquiry to expressing comfort after the inquiry experience.

Figure 3. Comfort with an inquiry approach. Teacher candidates’ description of comfort level during and after inquiry project.
**Significant learning.** Teacher candidates exploring inquiry learning may or may not have expressed changes in the level of comfort with this approach to learning, but when asked if participating in an inquiry helped them approach learning differently, 61% said yes, which may indicate prior thinking about learning was challenged. It is interesting to note that in Group 1, those who had most recently experienced the inquiry setting, 64% reported that the inquiry helped them approach learning differently, which could indicate strong potential for a change in disposition towards reform-based approaches like inquiry, as they were only four months into a 16-month program.

Regardless of the participants’ responses to the question concerning a change in their approach to learning, 83% of the participants chose to answer an open-ended question, asking about their significant learning from the inquiry experience. The answers given by respondents are summarized in Figure 4. Responses were grouped according to the categories that emerged within the comments. The most frequent responses as seen in Figure 4 were related to the category of personalized learning, including comments such as “choice and voice creates motivation to learn”, “I liked being able to personalize my learning by exploring a topic of personal and professional importance to me”, and “inquiry meets kids where they are and continues their learning”. A number of comments connected to the teacher candidates’ interest in shaping their classroom practice. One respondent said:

My greatest take away was how I felt at the end of it all. Although I had more questions, I had already learned so much. It's almost like you become an 'expert' in a certain area without even realizing it. I want my future students to be able to feel that same way, so I will definitely be implementing inquiry-based learning practices in my classroom.
One theme that appeared within several comments was the value participants placed on using multiple approaches to information gathering, and specifically the value that was placed on information obtained through means other than written material. Participants highlighted specific examples that they valued in their research during the inquiry as: “the ability to connect with mentors and role models in my area of interest”, “interviewing people to learn more about my inquiry topic was more effective than researching online”, and “it caused me to explore many different channels in order to learn more about my topic. Instead of focusing strictly on journal articles on research we incorporated interviews, observation, experiential learning”. One comment made several connections to various themes including personalized learning and the concept of learning from one another, as well as the value placed on professional learning with colleagues. The comment also connects to one of the First Peoples’ Principles of Learning (British Columbia Ministry of Education & First Nations Education Steering Committee, 2008) –
Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place). The participants’ experience of their significant learning was summarized as: “It was helpful to learn from my own experience as well as the experience of my peers, their knowledge of their own inquiries taught me a lot, from listening and talking with them”.

Another area that participants commented on as their greatest take away from the inquiry experience was the concept of scaffolding. One participant said:

I also appreciated the mentorship aspect, a structured process through which each student had two "check in" sessions with the teacher/mentor to discuss the inquiry, how it was going and the learning that was arising. The mentor was able to ask questions and provide feedback that extended my learning.

Other participants noticed the value of preparation, commenting, “the more time and effort you put into the planning phase of the inquiry project at the beginning, the easier it will be throughout” and “that learning can be open and discovered and can be a discovery process”.

There was also some frustration noted in two comments, with participants highlighting challenges with process and assessment. One participant felt that:

It all still comes down to who is marking/assessing you.

The other response suggests the participant struggled with the guides in place for the inquiry, perhaps wanting more freedom in their exploration and questioned how it would look in the classroom:

The inquiry approach we were given as post-secondary students needs to be modified for elementary students. We needed more freedom, as many projects didn’t fit the question
prompts. Therefore, it needs to be general when teaching, and the structure can’t be forceful.

**Context where inquiry is being used.** As the research developed, it was important to allow the participants to share their experiences in the classroom without imposing constraints around gathering information only related to inquiry within science. Ultimately, this broaden the scope of the research. Within the survey, respondents had the opportunity to not only state whether they were utilizing an inquiry approach in their practice but also the subjects/context(s) in which they were using inquiry. Science was the subject area identified as the most common context in which the teachers participating in this study use inquiry; with 86% reporting using inquiry in science. Figure 5 identifies the top six contexts where teachers from this study were using inquiry in their practice or classroom. The second highest context was cross-curricular, where an inquiry approach may lend itself well, as it would provide students the freedom to explore multiple topics while making connections. Humanities, math and professional development occupy a moderate usage point from the survey at 29-43% range. The three subject areas identified with the lowest frequency of inquiry approach being used are fine arts, languages and physical education at 14%.
Figure 5. Inquiry approaches within subjects. Context in which teachers are using an inquiry approach to teaching and learning.

**Change through the inquiry experience.** The change in a teacher candidates’ overall stance towards inquiry and whether or not the experience influenced their practice in visually represented in Figure 6, which shows the effect of the inquiry experience on the teacher candidates. By comparing three survey questions, I was able to quickly see the participants’ change in understanding of teaching and learning through the inquiry project, whether the inquiry experience altered their approach to learning, and ultimately if they are now using inquiry in the classroom. Half of the participants reported that the inquiry changed their understanding of teaching and learning, 61% reported that it changed their approach to learning, and of those now practicing, 58% identified as having used inquiry in the classroom.
Figure 6. Inquiry experience effect on teacher candidate. Response to whether the inquiry experience changed the understanding and approach to teaching and learning, and if they currently employ an inquiry approach.

A comparative visual of the effect of the inquiry experience is presented in Figure 7, with the data broken down into Groups 1, 2 and 3, concerning the participants’ change in understanding of teaching and learning, their approach to learning and whether they currently employ an inquiry approach in their practice. The largest group within the study, Group 1 (entered TEP in 2018 and currently completing their program), reported that 55% indicate the inquiry experience changed their understanding of teaching and learning, and 64% also felt that the inquiry experience helped them approach learning differently. Group 2 (entered TEP in 2017) results indicate that 50% of the group report a change in understanding of teaching and learning, and 75% of the group reports a change in their approach to learning and the use of inquiry. Group 3’s (entered TEP in 2016) results indicate that 50% of the group identify as having both a changed understanding and approach to teaching and learning and half of them are using inquiry in their practice.
Participants within Group 2 and 3 (already completed the program) had the opportunity to provide open comments about how participating in an inquiry project affected their approach to teaching. Although my research question focused on an inquiry approach to science in the classroom, in order to allow the participants to give authentic answers about their own practice, I chose to broaden the questions in the survey to provide participants an opportunity share their experience and provide insight into which areas they were choosing to use inquiry in their practice. Extensive comments were provided by 67% of participants. Four participants have been teaching exclusively full time since graduating, two of whom are using inquiry in their practice, but they described different outcomes from the inquiry experience. One participant stated, “I don’t think it [inquiry] changed my approach. The project was a self-inquiry and I felt it was a good experience for understanding more about my own goals in my career, but it did not inform my teaching approach”. The second full time teacher using inquiry, when asked if it
affected their teaching approach, responded, “it helped me to understand that teaching and learning are not always black and white and can be messy and that’s ok. Some of the most valuable learning comes from the moments of curiosity and wonder and may not always be expected”. The other two participants who identified as being full time teachers, stated they are not currently using inquiry in their practice and had no open-ended comments to offer.

Of the remaining eight participants who have graduated from teacher education, all work a combination of TOC and short-term contracts. Six of the participants, since completing the program, have had a mix of teacher-on-call contracts as well as full and part time term contracts. Within this sub-group, four stated they are using inquiry in their practice. One stated that inquiry has affected their approach to teaching because “it reminded me to be a facilitator of learning rather than a lecturer of learning”. The second participant offered this insight:

Yes, it affected my teaching approach. I have used both guided inquiry and self-directed inquiry in my practice. Participating in my own inquiry project introduced me to inquiry as something that I could incorporate into my practice. However, I didn't realize this at the time... Only now, looking back do I see how this [experience] opened the door.

Another participant who was also using inquiry in their practice, although they are currently teaching outside the K-12 system, stated that the inquiry did not affect their approach because “it was something I was already familiar with. The project did not affect how I approach teaching as it is something I valued prior to the program”.

Two participants, both of whom had a mix of part time contracts and teacher-on-call work, stated they are not using inquiry, but highlighted positive aspects from the inquiry experience. One participant stated, “it made me more interested in conducting an inquiry, but it has simply not been possible due to scheduling and time to complete
an inquiry process with my students”. The second participant commented on both the influence the inquiry had and also highlighted some challenges to incorporating inquiry. It maybe influenced the way I think about teaching and opened me up to other possibilities for learning projects and activities I could engage students in but it still seems like a big thing to implement in the classroom (i.e. something that would take a lot of time/work in planning, front loading with students, work to assess). As a new teacher competing demands on my time and classroom management have taken priority so I haven't implemented any of this new thinking I may have gained from participating in an inquiry project. My inquiry project was around questions related to teacher identity so some of what I discovered has probably influenced the way I am in the classroom and the way I think about my relationship with students.

Teacher candidate understanding of inquiry. Participants needed to recall feelings, thoughts, emotions and understandings from a prior experience, as recently as one month before the survey and up to a gap as long as two years in the past. A number of the survey questions resulted in large percentages in either a positive or a negative response. However, one question resulted in extremely polarized responses and a large percentage of neutral responses, which was not observed in the other survey questions. Figure 8 shows the spread of responses by participants when asked about their understanding of inquiry following their participation in the inquiry project. Participants felt strongly that inquiry is both a teaching and a learning strategy, allowing one to study something of interest and to a deeper level. Participants disagreed with the statement that inquiry is only useful for personal projects and is not appropriate for whole class application. The statements pertaining to the role of the teacher, including the statement that
inquiry can be used if led by the teacher and that a teacher is irrelevant in inquiry, elicited strong neutral responses, 52% and 30% respectively.

![Bar chart showing participant responses to inquiries](image)

**Figure 8.** Participants description of inquiry after project. The teacher candidates’ understanding of inquiry following their experience.

**Qualitative Findings from Interviews**

The survey allowed participants to answer a specific set of questions, some of which offered multiple choice and ranking outcomes, with some options for short answer. The goal of the semi-structured interviews was to give the now certified teachers an open-ended opportunity to share their stories, describe their experiences through the inquiry process in the program, and most importantly allow them to share what has been taking place in their teaching practice. There were three interview participants, which occurred through March and April 2019, each interview being approximately two weeks apart. The interviews were about one hour in length and they were audio recorded using iTalk with the participant’s permission. Participants were offered to choose the location of the interview, as I wanted to ensure they were comfortable. Each
interview occurred in a different location; one was in my office at the University of Victoria, one was at a coffee shop and the third was at the participant’s home. I began each interview by explaining the ethics consent form, allowing them the option to continue or withdraw at any point during the interview.

The interviews prompted participants back to their inquiry experience in the program and they were then given freedom to share the experiences in their practice that were the most meaningful. Although the interviews were recorded, notes were taken to capture themes that seemed to emerge throughout the interviews and note directional questions to use as a guide when clarification or follow up questions were needed. Each interview was very different, even the context in which we met played a role in the interview atmosphere. Each participant had very different experiences in the program, each with their own unique personality, teaching style and the context in which they were teaching. As the facilitator of the conversation and in order to create the most accurate picture of their experience, I needed to be sensitive to each scenario by managing when to push for more detail or encourage them to go deeper in their reflection. The goal of the interview was to capture the lived-experience through the inquiry project and how that shaped their teaching practice as they moved into the classroom. All three interview participants showed a relaxed demeanor and were given the time needed to fully explore their thoughts and unpack their teaching practice. The following three sections outline the stories and insights shared by the three interview participants, Tara, Janet and Joan. Each participant’s story is broken into five sub-sections, as the interview was categorized and coded based on the interview questions, the data that was shared during the interview and the themes that emerged. The five headings of each story used to present the findings in this section are: 1) The inquiry
experience; 2) Approach to learning from an inquiry perspective; 3) Inquiry experiences in the classroom; 4) Challenges to implementing inquiry; and 5) Supports for inquiry.

**Tara’s Story**

Tara began her teacher education program in September 2016 and entered the field as a certified teacher in December 2017. At the time of the interview, she had been practicing for just over a year, and was working full time between two rural public elementary schools. As Tara began the interview, it quickly became evident that teaching for her is a “full body experience” and that she finds the work truly joyful. She continued to get excited as she talked about what was happening in her classroom, with flashbacks and links back to her teacher education and the inquiry experience. Throughout the interview a number of themes emerged, but one statement summed up her growth and where her practice was at; “I want to build successful members of a community and that goes much more beyond just learning in a classroom”.

**The inquiry experience.** Tara’s interview started by prompting her to think back to her time in the teacher education program and asking her to recall her experience through her inquiry project. She remembered choosing an inquiry topic that she wanted to know more about, but because inquiry was new to her, she also chose a project in which she had some previous knowledge in the subject matter. Tara recalled that the inquiry “started the professional development side of inquiry for me”. It wasn’t an easy road, however, as she remembered the struggle of “starting with inquiry and what does it actually look like”. As she thought about where to begin with inquiry she stated, “I ask questions all day when I'm teaching but how do you take one of those questions and refine it?” Tara reflects back to her time in teacher education and touches on the complex nature of teaching, where inquiry fits in, what she feels can be taught, and what teachers need to develop.
When you're in an institution, what you're doing is content. We're doing content, content, you have a little chunk of kids but it's mainly content. It would be tough to do a relationship-based inquiry on a three-week or a nine-week practicum. Because it's not the same as having your own classroom and your own kids. I think the way that you do inquiry in a short sixteen-month teaching program has to be different.

She went onto recount how her view shifted once she had her own classroom as she began to solidify what was important to her in her practice and incorporated inquiry thinking into her professional development.

Then you get out in the real world and you start to realize that you can't teach any of that stuff you planned if you don't have the really important stuff. So I think naturally your lens would change from content, content, content to holy smokes this is so much bigger, teaching is so much more than content. So how can I refine my practice in ways that are not content-based.

Towards the end of the interview Tara circles back to how the inquiry experience in her teacher education began to shape what would later become an inquiry approach to her classroom and to her teaching practice. She recalls that the inquiry project for her:

…opened that door, but it wasn't as though I thought, ‘I loved this inquiry and I'm going to do inquiry for the rest of my life’. As with many things, this is something that is good practice and what you carry forward with you is the stuff that sticks with you. I connected with inquiry and it clearly stuck with me a little bit because I carried it forward with me.

Finally, Tara shared one of her core values around inquiry and the connection to community with the statement:
I think that so much of teaching for me is community, not just with kids but with other teachers. What inquiry does is begs you to create a community of people who are also reflective and who might also share some of the same values.

The message of community and the importance of it to Tara’s practice became an underlying theme throughout her interview.

**Approach to learning from an inquiry perspective.** A number of categories began to form as Tara spoke about her approach to learning from an inquiry perspective and the links to her inquiry experience two years prior to the study. An area that Tara highlights as a cornerstone of her approach is to have a practice of questioning: “I ask questions all day when I'm teaching”. She would push students to think critically by asking probing questions when they were stuck or something didn’t work with questions such as, “how will we fix it?” to help get the students past their stumbling block. She noted her struggles with the balance of how much to teach versus how much to allow her students to discover on their own and with limited reading and research skills commented, “how do we do inquiry in a way that's not just me feeding them information that they're going to turn into a project because that's not really inquiry, that’s still standing up front and teaching kids things”. Her questioning approach was not just for the students but was incorporated into her own practice when she asked herself questions such as, “how do I have them [students] otherwise find information, if reading levels are low?” Tara has found success with an inquiry approach “in science because so much of that you can do through physical discovery. For example, with magnets, just put them out and have the kids see what they learn”.

When the end result of discovery learning is for “the kids to see what they learn”, it is a strong indication that the teacher’s approach to learning is student-driven. This value was apparent when Tara spoke of her multi-grade classroom where she was running inquiry projects
and in order to be a student-driven learning space, she pointed out that it is critical to “remember what a grade 2 [student] is really capable of. They don’t need to be able to read to see that magnets push each other away”. Tara’s aim to be student-driven and desire to meet kids where they are at was evident by her appreciation that:

the depth of discovery in kindergarten is different than the depth of discovery in grade 6. As long as your groundwork and your rules and routines are laid down really well then inquiry in kindergarten is a lot of hands-on, just building and playing and discovering. It's different than in grade 6 and 7 which is still hands-on but you also have to have that component of deeper knowledge behind it.

Participating in an inquiry experience helped build Tara’s understanding of some of the key aspects to the inquiry process. She was then able to apply those structures in her own classroom when incorporating inquiry approaches. Deciding what was important before beginning an inquiry was found to be one area Tara focused on: “the whole of inquiry, it's really important to have essential questions and it's really important to do research and it's really important for kids to engage and create in an authentic way”. Tara struggled with “what's inquiry for grade 2 versus what's still teaching and where's the line?”. This struggled emerged in the conversation when Tara articulated her attempt to help her younger students form questions and make connections while trying not to venture into a teacher-directed model. In her approach to research in the classroom, she focused on having kids discern “what was important” and put scaffolding in place to facilitate those skills and she notes, “it's still facilitating inquiry and teaching the process of inquiry which at the end of it is really what the goal is. It’s learning content through learning how to do an inquiry”. As Tara became more confident in her own
practice, she found herself letting go of the expectations of what inquiry needed to look like at any given time of year or the level of scaffolding needed as:

the line [inquiry versus teaching] is different in September than it is in June because they haven't done an inquiry in September. By June hopefully they've done a bunch and so they have some of those research skills or detective skills. So being okay with saying this is an inquiry in September and we're going to do it together every step so that you learn the process of inquiry and then by June hopefully they'll have more of a handle on what it looks like.

Tara has been a successful student herself, with an undergraduate degree, and performed well in a system that taught her what to do, how to do it and when to do it. However, when reflecting on her experience with inquiry and what she sees as successful teaching and learning, she highlights, “it's totally changed the language that I use with the kids at school”. There was a significant shift in Tara’s perspective around the concept of “being right and getting the right answer”. She reflected “we need to really work hard together with parents to change the language that we use at school about getting it right”. She pushed her students to think critically and rather than asking the educator in the room “is this right?”, she teaches them to analyze, take ownership of their learning and say “I think this is right because...”. This major shift in approach to learning in her classroom, and going against her own comfort in a system set up for “being right”, she attributes to her experiences with inquiry.

I've changed from my ‘check the list and do it’ to now my teaching is really, learning is not learning to get the right answer, learning is learning to get the information. To create lifelong learners, we have to create people who don't just come to school to get the right
answer we have to create people who come to school to gain knowledge. I think inquiry is a really great way to do that because it's authentic.

**Inquiry experiences in the classroom.** There are several ways in which inquiry has found its way into Tara’s practice. During the interview she shared her experiences of her practica, within her school and classroom, and how inquiry has been embedded into her professional growth. Within the last two years, through her teaching experiences in the teacher education program and while teaching full time since being certified, her practice around inquiry has grown immensely. She recalled that during her practica experiences, both in primary classrooms, she had the opportunity to experiment with an inquiry approach during math and science units. In both her practica she “did financial literacy for math”, where the culminating event was “a store, so they earned paper coins and then they got to budget for the store”. Tara shared cautiously, “so that was kind of, I think, my first actual foray into, or a touch into, inquiry because the kids hadn't had experience with coins and spending money”. She describes this hands-on learning and learning new content as powerful because they “learn through actually doing things”. She taught a unit on thermal energy in science during her practicum and was able to teach that unit again in her classroom, where she focused on learning through action.

Tara now teaches in a school that has taken up inquiry as a whole school approach to learning, for both staff and students. She proudly stated “my school, when you walk in, there's a bulletin board that says our inquiry and there's an inquiry spiral, that everybody sees, that it's very visible. That's the first thing you see and that's the culture at our school, is inquiry”. One of Tara’s first significant jumps into large scale inquiry with students was within a whole school-based inquiry, where all students, K-7, were exploring force and motion as the overarching topic.
Each grade focused on a different Big Idea within the curriculum and she described how the teachers set up the students to learn in each of their contexts:

We did force and motion. The kindergarten and grade ones made push and pull toys, grade 2, 3 & 4 made marble mazes and the grade 6 and 7 did a presentation and a demonstration about one of Newton's three laws. That's all at grade level, it's all on the same topic... We used a lot of KWL charts, what do we already know, what do we wonder and what have we learned. Go play with those and then come back, what can we add to the know part of our chart and what are you still wondering and then what have you learned.

Tara reflected on the planning and the role of inquiry in multi-grade scenarios:

That's why inquiry works. That’s the only way to do it, when you have a multi grade class like that, grade 2 to 7, the only way you can teach is by saying, ‘this is the topic, this is what you need to know at your level, show me how you know it’. That's the only way that you can do it.

Another inquiry approach used by Tara was with multi-grade small groups exploring a common essential question; “why do some towns boom, while others bust?” She compared how her role changed in an inquiry setting while working with a single grade group versus a multi-grade group. She noted when working with the older students (grade 6 and 7) in an inquiry, her role was one of guide and “proofreading whatever they've come up with”, where she was often asked the question “can you read this to make sure it makes sense?”. When students struggled to find information, she offered guidance by “providing some places to look, pulling some books or resources”. With primary students she noted, “the grade 2s it's still a struggle to know when to jump in and when to not. With the last one [inquiry] we did I didn't jump in at all, because they
were building”. During the boom or bust inquiry, Tara noted how her “role there was actually facilitating group work more than it was resource providing or anything”. She focused her guidance for the small groups by asking questions such as “how can you work better as a team to come up with a final project?”.

An area of significant growth for Tara was her intentionality around assessment. She recounts, “this was the first inquiry where I was really intentional about creating language about criteria and a one, a two, a three, and a four and turning that into a rubric”. She began to create an “inquiry checklist” to help connect the outcomes to the assessment. She outlined the criteria: “decide the learning outcomes, create an essential question, imagine final product/projects, co-create criteria, allow work time, provide resources, refine, and present”. One question that Tara built a classroom community experience around was deciding “what is important?”. The goal was to create criteria of what the group valued as important cornerstones but also to build their skills in self-assessment.

Going into this last inquiry I really wanted them to get the language of being able to create something and compare it back to what we said was important. I really wanted to drive home co-creating criteria and then giving them the language to look at the criteria and place themselves on that criteria, deciding where they fit. In my teacher brain they were doing an inquiry but I really wanted them to have the language of ‘minds of three’ or ‘minds of four’ and they did… they picked that up. I had kids saying ‘oh I’m done and I think it's a 3 because blank reason’. That is actually what I wanted to get out of it, getting the authentic criteria… then you building it and being able to look at what you built and place it on what we decided was important. That was what I wanted them to get out of this inquiry.
Although throughout the interview Tara describes several ‘projects’ in which she had used an inquiry approach, what also emerged during the conversation was her overall approach to learning through an inquiry lens. She recalled thinking, “it's that scary thing, to say, okay we're not all going to do the same thing”. She explains further:

My kids don't all do the same math, they don't all do the same English, our school is really, really good and I'm really proud of how hard that I work and that we work at meeting the kids where they are through small group math circles, through daily five, through inquiry… I maybe direct teach to have them all sitting and listening for 20 minutes at the beginning of daily 5 and that's the only whole group instruction I do. Not only does Tara incorporate inquiry into her classroom, it has become part of her professional growth, personally and within her network of professional learning. Building a sense of community in her classroom and with her colleagues was of utmost importance to Tara:

I make really intentional efforts to call parents, I call two parents a week period. Great stuff, stuff that needs to work on, just to check in. That's what's important to me so that's what I make time to do…And that's part of my teacher inquiry is how do you make kids feel connected and important and belonging in our community. A lot of that is they’re not only in a community at school but they’re in a community at home.

**Challenges to implementing inquiry.** Tara was only a year into her teaching career when we met for the interview; however, she was able to share stories of engaged learners in her classroom, taking risks and exploring independence. She was also very articulate about the areas of inquiry that challenged her. Not only is she new to teaching but inquiry, as an approach to learning, is still not commonplace in our classrooms. Early in the interview Tara described one of the big stumbling blocks for her:
What I think the biggest challenge was, is that because inquiry is a newer way of doing things, there's not a lot of ‘this is how you do an inquiry’. And I know that you can't say this is how you do an inquiry because that's not really how it works. You start with a question and it changes and adapts. But that was also the biggest struggle I found with teaching inquiry…where do you start? How do I teach a grade two how to do an inquiry? Because they can't do research on a computer, they don't know how to operate a computer, they can't read. So that struggle relates back to my starting with inquiry and what does it actually look like.

Tara reflects back on where she was in her practice and managing the steep learning curve of a new teacher and needed to draw a balance of the demands, recalling that “in a new teacher world there's all these things I know are right and are good practice and these are all the things I can manage to do right now”. She articulated that “actually sitting down dedicating the time when you're first starting is really tough, especially if you are not in a school culture that is conducive to inquiry”. The theme of ‘community’ continued to emerge throughout the interview.

A stumbling block or frustration of implementing an inquiry approach was that “teaching inquiry can be tough because you're; a) letting go of the reins, and b) nobody ever teaches you how to do inquiry”. Although she acknowledged “you can’t say ‘this is how you DO inquiry’ because that’s not really how it works”, Tara remembered back to when she started her first inquiry with kids, and she “didn’t even know how to start”. She described it feeling “overwhelming”. Adding further to the feeling of being overwhelmed due to the uncertainty of where to start, she highlighted that she was “starting with kids who she didn’t know and didn’t know what skills they had”. The skills that the students possess and their lack of experience with inquiry learning is also the product of the system, which was described by Tara as:
We have kids who have been trained by a system; this is how you do this, do this and you'll do it right. They haven't been trained to say ‘this is what you need to learn, okay, now learn it’. It’s just the result of the system where this is what you have to teach, so you teach it, and they do a project, and you move on. I think we're still trying to do inquiry in a system that's not…it’s not creating inquiry, it's not facilitating inquiry, unless that's what a teacher wants to do… It’s the systemic disconnect between what we know is probably really good teaching and learning and what we're doing on the ground because of a variety of reasons.

**Supports for inquiry.** Inquiry happens in classrooms and schools where there is support for innovative approaches to learning. One of the key components Tara identified for herself in incorporating inquiry approaches into her teaching was “the principal and the administration and the way they run it, dedicating specific time to inquiry”. There was support within the school as the “principal has built our days that we have 25 minutes every week to sit as a staff and talk about our inquiry [teacher inquiry and school wide student inquiry]”. The support was also evident in the larger context as there was also a district leader “who liaises with all the schools and their inquiries, who comes out and visits, asks really good questions, gets you thinking, and then leaves comes back and has a check-in”. Tara summarized her thoughts as “it's really important that teachers feel supported in their own journey as teachers and have the time to sit and connect and talk and figure out their own practice”.

As Tara reflected on her year, she was aware that repetition and continued implementation, on whatever scale, is critical; “now that I’ve done it six times I’m now just at the point where I’m ok”. She said that for her personal teacher inquiry she “wouldn’t dedicate so much time to it if I didn't have a principal who was wasn't so into it”. As for incorporating
inquiry with students, she predicted, it would be challenging “doing inquiry with the kids if it wasn't in a school that really focused on that, because it is daunting”. Tara concluded:

I think my inquiry journey has been really helped by the culture at my school. I think that's probably the biggest contributing factor and the fact that I am a reflective person. When my principal says you're doing a good job, she always follows it up with ‘and it's because you think about things all the time’. I'm always thinking about what worked, what didn't and that's just me as a person, I’m thinking about things as I go, that reflection side of it.

As Tara pondered her classroom, her practice, the system and the new curriculum, she left the conversation with a final thought concerning the speed at which the field and system changes:

I believe in what we're doing, I just wish that it was faster. It’s equivalent to changing the course of a canoe versus changing the course of the Titanic. A canoe you can change on an instant and it takes one person but a Titanic takes lots of people and sometimes it sinks along the way.

Janet’s Story

Janet began her teacher education program in September 2016 and entered the field as a certified teacher in December 2017. At the time of the interview, she had been teaching for just over a year, and was working full time between two urban public elementary schools. As Janet’s interview began, she seemed quite nervous. The first few questions were designed to relax the interviewee but she quickly revealed that she was not sure if she is doing inquiry or if she even really knows what it is. After a few minutes, I was able to get her sharing her experiences as we focused on her practice and what she was doing in her classroom. Janet is a passionate, caring educator whose love for her students and their learning quickly became evident.
The inquiry experience. Janet’s initial experience with the inquiry project in her teacher education program she characterized as one where she was “feeling agitated”. She mentioned having no prior experience with inquiry and is “still unclear how inquiry looks in the classroom”. Janet felt frustrated that so much time was dedicated to an inquiry because, really when you get in the classroom, this isn't what we want to know right now, we want to know how to be better teachers in the classroom. How to handle kids with special needs, and we didn't get any of that. So first I had to get past that because it was quite frustrating being in the program and not getting that.

Janet also mentioned that the inquiry was a “bonus but not necessarily what we needed in that moment”. She admitted that she had to manage the frustration of not getting what she felt she needed and perhaps “didn't get as much as I think I could have gotten out of it because of that mental block”. However, Janet began to see another perspective and stated, “I don't know if inquiry ever stops, if that's who you are as a person. Because if you're just trying to better yourself all the time then that's what inquiry is. And that's what this class was about.” She recognized that “you got as much out of that class as you put in”.

A further disappointment for Janet was the class was non-graded and therefore was “pushed to the back” because she viewed it as less “important” and “something that wasn't benefiting me to be a better teacher”. When asked about transferring her experience with inquiry and into her practice she commented: That’s the thing, we have no idea how to transfer it into practice because it was never shown what it looks like in a classroom that is full of children not adults. I could easily run an inquiry with a group of adults but show me how to do it with five-year-olds, because I'm teaching kindergarten, so how do I do that?
Approach to learning from an inquiry perspective. As Janet began to share her experiences from the classroom, it was apparent that her top priority is to focus on student-centred learning. When asked what kept her going through the frustrations of beginning her career, she stated; “it's not about me, it's about them. It’s about how far they can get in that year that you have them”. She reflected on her ability to “teach outside the box” allowing “for more growth because it takes away the walls”. She found it “less stressful to let the kids explore the way they're going to do things”. In this exploration she has also found that given the freedom, the students would come up with more creative ideas and often found herself thinking, “they're always way smarter than I am. I never would have thought of it like that, that's a good idea”.

The learning curve for new teachers is very steep and can feel overwhelming at times. Janet has found that she likes to approach her classroom and practice from a positive outlook, as “negativity breeds negativity”. Rather than getting pulled into negative conversations about a particular student’s behavior, she’ll instead offer, “they're lovely (even if it’s a lie), they're just wonderful, they're just the best” because she wants to “add to that kid’s story”. When asked about what she does when she is feeling overwhelmed, she responded:

We dance. I love them. They're 5 and 6, they're just little. They hug your leg and they bring you little flowers at recess every day, and little pictures and they’re just so cute. Their noses are always running. I’m always blowing noses and asking if they need to pee.

I like kindergarten a lot. I want to teach littles.

Janet approaches learning in her classroom with a social-emotional awareness, focused on core competencies and finds that “kindness” is a big part of what she teaches. She focuses on three areas when she’s assessing group work, “If they’re participating, that they're kind, and if
they’re able to come back from failure. These are the things that we talked about”. She asks her students to self-assess and gives them guiding questions such as:

Can you bring your classmates up instead of putting them down; putting them down, or putting their ideas down? How do we word it so it's lifting up instead, even if you don't agree? That's a big thing; How do you work with someone you don't agree with?... Can they get their ideas across? Are they speaking up?

**Inquiry experiences in the classroom.** It became obvious through the interview that Janet loves being in the classroom and working with students. She mentioned multiple times, when referring to teaching, “it’s fun”. This attitude came out clearly as she began to speak about what she is teaching in her classroom. She started the interview questioning what inquiry was and what it looks like. To get her past a ridged definition I simply offered, “when you start asking why, it’s inquiry”. We explored her teaching practice and how inquiry can look different in different contexts but ultimately the first step towards an inquiry approach is when you change your practice from “telling to asking”. To which she responded, “Okay, well I always do that”.

Janet has found it’s more difficult to approach writing and letter formation from an inquiry stance, as “it has to be done a certain way and pencil grip…these things you have to have a box”. One approach she has used in math with her kindergarten class is by simply asking questions like “how many ways can you do eight plus one?” and leaving the possibility open for multiple answers. An area which was new for Janet was STEM, which she was asked to teach, by her teaching partner, with their intermediate class:

In my 4/5 class, I teach STEM. I teach the hands-on part so that's very easy. I give them a pile of stuff. We do a lot of story stem, so I read a story and then a problem arises and
they have to fix that problem in a group. Next week they're dropped into the Arctic and they're freezing to death. There's a whole story and then they have to build a hut.

Janet was initially hesitant to share her STEM (an interdisciplinary and applied approach to teaching science, technology, engineering and mathematics) experience because she didn’t see it as inquiry. Once we were able to frame the conversation around guided inquiry which includes posing questions and giving students the freedom to explore to see what they come up with, Janet began to open up about all kinds of learning taking place in her intermediate classroom. She began by confessing, “I used to be afraid of STEM because it was messy and expensive but it's not. I asked parents to send stuff in and it's the students’ favorite. They love it”. When she first started with STEM she noted that although “I've done STEM where there weren't as many parameters, they get more out of STEM if there are some parameters of what I'm expecting at the end. Otherwise it's doesn’t have a focus”. She found more success with using story STEM, as it helped put some scaffolding into the process:

The story STEM is quite interesting because there's an actual problem that they're trying to solve and I find that's more effective for them learning. And half of them fail. But that’s not what it's about. It's about the process of it, how they figure out the problem, and when it collapses, what are they going to do to pick themselves back up. They love it, they love STEM. I will always do STEM I think, within my own classroom.

An area that emerged during the interview was the concept of failure. When Janet was asked what gave her the confidence to not only try something new but actually let the students take the lead, she was quick to respond with, “I failed at least four times before it started working”. Although she classified her beginning stages with STEM a failure, she continued on because she didn’t “want to do anything half-way”. She remembered thinking “if they're not
Janet also built into these “failed” attempts, a mechanism for reflective learning. She recalled:

Every time it failed, we laughed. We laughed so hard. We talked to the group and said this was a total failure. So, what can we do better next time? Let's figure this out. We tried something new and tried something new and then I found the story STEMS and they're much more guided and the kids liked them better. We always have a little powwow at the end, what worked and what didn't? They self-assess at the end individually. How did I work in this group? Did I do what I was supposed to do? Did it work out?

**Challenges to implementing inquiry.** Janet circled back to a stumbling block for her, which was based on the definition or how we tend to categorize inquiry. She mentioned “I don't do specific inquiry where I’m like, okay we're going to do an inquiry project”. Although much of her teaching practice is shaped around an inquiry and questioning approach, she felt she was not “doing” inquiry because she wasn’t doing projects. Janet mentioned that she still struggles with “what would inquiry look like with five-year olds?” as she thought about the project focused approach.

As we continued to explore how Janet was incorporating inquiry into her classroom and her practice, a challenge that kept emerging was the idea of how to remove the teacher from the exploration and the teacher’s “rigid way that we want the outcome to look”. Janet was intentional about not showing a picture or giving direction of how to build a structure, she just “gave them a guideline… it has to be this tall, this wide, here are your materials, and you don't have to use them all”. However, she gives a glimpse into her teacher mindset and admitted that:

I find that hard, I’d like a picture of what it's supposed to look like. But if I get a picture, I'm going to show it to them and then they're all going to look the same. So that was a
hard one for me. It’s still hard. As me and my EA were looking at the Story STEM for next week and we were already so frustrated. I just want to see what it is supposed to look like.

The issue of time and classroom dynamics played a key role in Janet’s ability to implement an inquiry approach with the students. As she was split between two classrooms, she had limited time with each group. She found the learning and emotional needs of her primary class outweighed her success with exploring inquiry and recalled,

It's hard to open reading and writing up, especially since I have two kids reading at grade level and seven ELL’s, two with trauma, two from Syria. One steamrolls across the floor for part of class. One is crying on my lap while I teach a lesson, it’s just so ridiculous.

There's a lot going on in that class.

**Supports for inquiry.** There were some straightforward ways in which Janet found more success with an inquiry approach with particular aspects supporting inquiry in the classroom. She found that some guidelines allowed her students to “get more out of STEM” and was “more effective for them learning”. She found that she needed to be prepared with materials but also with “something in my tool belt, for the kids that are really struggling, I can give them some ideas because otherwise they just shut down”. But the major theme or tone that came out of Janet’s interview that lends support to her incorporating inquiry was how she was building trust in her classrooms. She articulated this phenomenon when asked how she has moved beyond a stand and deliver model:

I’m a big fan of teaching self-worth, talking positively about yourself in every aspect.

Instead of me saying good job to them, getting them to say ‘I’m proud of my work, I’m proud of my hard work’ and really getting them to do it. In my grade 4/5 class we do self-
love for the first 15 minutes of every Thursday. I only get them one day a week and at
first, they hated it. But now they’re making bookmarks… and can say how much they
love who they are and tell me why. But it took a long time, it took a long time and some
kids are really difficult.

Janet shared a touching story that captured how she builds trust with her students, so they will be
comfortable to take risks, even if it means failing. She is building a community where students
have a sense of belonging and know that she cares for them. She continued to speak about
creating safe spaces for all her students by recounting the following experience with a student:

I had an experience with this little boy that everybody can't stand and he's six…he’s six.
Why does everyone hate this kid? I looked at him and said you're a good boy, he said I'm
a bad boy. Then I touched his face and I said it 10 times in a row and he just flushed and
started to cry… so my whole approach with him has to change.

Joan’s Story

Joan began her teacher education program in September 2016 and entered the field as a
certified teacher in December 2017. At the time of the interview, she had been practicing for just
over a year, and was working full time at an urban independent elementary school with middle
school aged students. Joan was excited to meet and share her experiences of inquiry from the
classroom and through her teacher education program. Throughout the interview her passion for
teaching and working with students permeated the conversation. An overall theme that emerged
during the interview was Joan’s desire to create an engaged community of learners within her
classroom by modeling curiosity and wonder with her students.

The inquiry experience. Joan recalled that she “didn't really understand what an
inquiry project meant” as it was something she had never done before. But she “just went with it
and was open minded”. Inquiry was being talked about in other courses, some instructors were using the term passion projects. Joan felt for those projects “it was a little too open-ended” with no direction, giving it little purpose and no connection to teacher education. She remembers feeling open to the inquiry experience in her fall seminar and described it as feeling “a little bit more directed, like there was a purpose behind this inquiry project. I was open minded to it and I embraced it”.

One of the challenges Joan encountered was “knowing what to pick” as an inquiry question. It felt “a bit overwhelming around the choice of…you can do anything you want”. Before entering the TEP, she didn’t recall “having a whole lot of choice” about what she could learn. Joan recalled that she chose her topic of “partnership with elders in a school setting” because she had previously “been exposed to a 55+ club” in partnership with a local school. Despite having chosen a topic, the reason for the discomfort she describes as:

> I didn't really know where I would end up. I didn't know; okay this is where you start, these are the steps, this is what a finished product was going to look like. So, I had to trust the process versus understand the finished project or product.

Having had some distance from the inquiry experience, Joan reflected on the experience:

> So looking back, I don't think there is a finish to it [the inquiry]. I maybe didn't realize that at the time. I kind of wanted to know and now I realize, this is just the beginning of exploring something. That probably was taught to me but I probably didn't understand it until now.

**Approach to learning from an inquiry perspective.** Joan’s top held value in her classroom became evident as soon as she started to talk about her practice. Above all else, she strives for a classroom of student-centered learning, as she articulated, “my biggest concern is,
are kids engaged in learning and are they growing wherever they are at?”. To build a community within her classroom, she highlighted working “really hard at creating a classroom where the engagement is high”. She felt she achieved this engaged culture with her students because they “are trusting this to be a very safe place”, where they aren’t going to be “judged…or have a rigid assessment…so they can freely engage in learning and take risks”. When asked how she created this engaged classroom, Joan attributed this engagement to curiosity, from both her and the students:

They [the students] were all really curious. I was too. Everything I'm doing is for the first time right. I think partly being a new teacher. And I hadn’t studied these topics before. So I bring a curiosity as well. I'm not up there with the answers. I'm thinking, let's discover this together and we're sharing our knowledge.

The “community of curiosity” Joan created within her classroom was a strategy used to enhance engagement. When she thought about how she was approaching learning with the principles of inquiry in mind, several other techniques and values she has in the classroom led to inquiry thinking, such as, “the being okay to not know, what kind of questions do you have, what do you know already about this, what have we just learned, now what questions do you have, and what more would you want to learn”. This led Joan’s practice into one of questions. Early in the year, she focused her approach to teaching with the intention of “modeling inquiry” showing “something that was a bit more guided…it looked more like guided inquiry”. This modeling of a questioning approach helped provoke students’ curiosity with “lots of questioning, and lots of trying to bridge it to accessing prior knowledge”. It was a natural next step as they began to explore the idea of essential questions or “questions that don’t have easy answers” and that those answers can be different depending on who is answering.
The final concept that Joan focused on in her classroom practice and her efforts in using an inquiry approach was the idea of personalization, and using choice and voice of the students. She made efforts to provide choice within all subject areas, whether it was literature circles with choosing novels or math with choosing what they felt they needed to learn the material. She stressed ideas to her students like, “try and find a question that’s going to challenge your brain. If it’s boring, you’re not learning”. During an inquiry project, Joan allowed students “the opportunity to pick an area of interest” and explore any area of their choosing. She asked them to choose something that had personal meaning for them but also asked them to “think about how this [topic] makes connections” back to a concept they had studied together earlier in the year. Joan valued student ownership of their learning, which became apparent when she implemented inquiry into the classroom.

**Inquiry experiences in the classroom.** Joan’s passion for learning alongside her students was evident during the interview through her excitement about her own learning in new areas. Her desire to create an environment that values curiosity, wonder, pushing the status quo and creating authentic experiences in her classroom was evident. She was intentional about first creating a climate that was conducive and supportive of inquiry learning, by ensuring her students were “trusting this to be a safe place”. She worked hard to take away “all stressors so that they [the students] could freely engage in learning and take risks for learning”. When reflecting on how she knew the students were ready to take the lead with an inquiry approach, she recalls, “when I started to see them doing this [taking risks], then I knew they were ready. I don't think it was as conscious as that but I just felt like it”.

The class explored several different areas of science and social studies in the first half of the year. Joan remembered “I provoked their interest in a lot of different topics…where I was
modeling inquiry, but maybe something that was a bit more guided”. Her focus was, “let’s be curious about this, what kind of questions do we have?”. Joan brought with her to her classroom a passion about social justice, inequality and environmental issues. Together with her students, they tackled large, overarching topics like, “global inequality. We read books about it, we watched films about it, we went down to the Mustard Seed [food bank], we asked questions about it, we wrote about it, and the engagement was high”. Another area they explored was “space and that was another heavily guided inquiry”. Joan took advantage of a local science group resource kit to have her students learn about the International Space Station (ISS), which incorporated science, math and technology:

The project, called Living Space, was actually looking at coding sensors for the classroom, to look at our local classroom environment and compare it to the ISS. It looked at temperature, humidity, and carbon dioxide. The kit came with micro bits and a sensor array. The kids coded stuff for our classroom. We gathered data and then we looked at the ISS. We looked at some really cool videos of what it looks like out in the ISS. What do you astronauts do out there? What kind of training do they have to do? What's the environment out there like? You can even live stream the ISS.

In the second half of the year, the middle school students at Joan’s school typically complete a study on a country. The students pick a country and “find out the population, the flag, the language, the culture, the food. They fill in the blanks, the GDP… and they make a little booklet”. But Joan was inspired to try something different because “it just seemed really boring and… these kids are so interested in life”. She watched and took note of her students’ interests and wanted to provide an opportunity for students to follow an area of passion or perhaps going deeper into an area they looked at earlier in the year:
There are a few kids that love space, that is their passion and I knew that when we did this Space Station, they just shone during that time. There are some kids that love history and love learning about conflict, historical conflict, and wars. I see what they're reading too. There's another kid that just like loves Leonardo da Vinci. So why not give them this opportunity to pick an area of interest that they can study and guide them through an inquiry.

Joan had each student prepare a proposal for their individual inquiry, which included “essential questions, what search terms they would use” and the general plan for the project. There were two pieces to be completed, “an expository essay as well as a deliverable…anything from a poster, to a game that they create, to a book that they write, to a service project, to a PowerPoint presentation, to art”. The project did not have to be based in a particular subject area but Joan required the students to “think about how this made connections” to other topics they had studied during the year. Joan also used this opportunity to further the students’ writing skills; by using their chosen topic, they applied their newly acquired knowledge to form the basis of an essay.

A couple of students in particular affected Joan’s outlook on inquiry learning. One student decided to “study architecture for her project”. Her project looked at the “big movement around tiny houses”, which she was able to link back and connect it to the idea of “inequality and…affordable housing”. It turned out that this student had been tested and was gifted in a couple of areas including “space; the use of space, objects in space, flipping, and patterns”, but it hadn’t been noticed in school before. Joan recalled:

It has never showed up in school before and now, I get to see it. She just naturally chose this passion project, that led down this route, that was not at all controlled by me. But she
tied it together with what we studied about inequality and affordable housing. She was just so curious about listening to the news and about housing issues and homelessness. The second student decided “to study about the American Civil War and it happens to be a passion of his dad’s”. But Joan noted that the project “allowed the two of them to connect in such an important way around his education”. She saw a change in the student as he became excited to “learn about the American Civil War”. Not only was he connecting to the content he was learning but also connecting in a new way to his family as he would “talk to his dad about it, come back and write about what he learned and they watch documentaries together on it”. Joan shared about several other students’ inquiry projects but ultimately took away from the experience that it gave her the opportunity to help “provoke something for them [the students]”, and have a “door just opened up” where the students “get to nurture that” passion and find where it’s “applicable”. Joan’s greatest take away and joy was noticing that “the kids are actually interested in what they’re learning”.

Challenges to implementing inquiry. Remembering back to her practicum experiences, Joan recalled, “I really didn't feel like there was an opportunity in my practicum to explore inquiry learning”. She quickly highlighted three reasons for what prevented her from trying inquiry with her practicum students; “time, relationship, and confidence”. She remembered feeling awkward in practicum, stating “practicum is this weird place…you're trying to do your own thing but really in someone else's shoes”. As she thought back to what else stood in her way she remembered; “it didn't feel super free to do that [inquiry]. Also, I’m not experienced, I didn't want to take that risk maybe. I didn't even look for it actually and I didn't see it happening”. She felt overwhelmed with the newness of her teaching role and the complexity of teaching in her
practicum and recollects, “you're just keeping your head above water in terms of getting used to the whole idea of teaching”.

Joan’s foray into inquiry learning, once she had her own classroom, did not come without its challenges and frustrations. As with most new techniques or strategies we try, one of the most common feelings is not having confidence in the new venture, as Joan put it, “just developing my own confidence around the whole process”. One area she struggled was with the line between letting the students explore and when to inject herself in with some teaching for skill development in order to aid the exploration. Joan explained her thinking as:

Once they [the students] did their proposal, they needed to do their research. I did not do that part well. I should have guided them through research and how to take notes. But a lot of them engaged in the research but they didn't document their research well.

A second area Joan found challenging was the concept of how the students shared their newly found knowledge, in the form of a product, which she called “the deliverable”. She reflected:

I probably need to do that piece a little bit better as well or spend time talking about what deliverables could look like. Almost say you can't do a PowerPoint presentation, you have to do something different. It's almost like a default, they're comfortable with that because they've done it before…I'd like them to start to think about…outside the box. Some of them are putting together the typical science board or a poster but I want them to… You know maybe there's a kid who could write a song, or there's kids that could do an art piece or a service project of some sort.

Joan articulated a struggle with timing and scaffolding of the inquiry project, including how the final presentation set up would work. She described the pace and timing of the inquiry project as, “it’s like a runaway train. Everyone is at a different place”. She found it difficult to
keep the students in the same phase of the project and noted, “someone's just still doing research and another person is ready for the deliverable”. Joan was conscious of her students each having individual needs and skills, and admitted, “keeping 24 kids on the same timeframe is challenging, especially with all the different learning needs. I'm not quite sure how to do that”. Although she experienced this chunking as through her own inquiry, that knowledge did not seem to transfer to her new situation. Throughout the inquiry project, Joan continued to contemplate the best course of action to scaffold the students’ pacing:

When you have this huge project that takes many, many weeks to go from A to B, how do you chunk? You can't give it all to them at the beginning, that's too overwhelming. How do you chunk it, while giving them some freedom in that process? Part of it is that they are discovering along the way. Sometimes your research just takes longer because you can't find the sites or videos that you need. The longer this project goes on the more a runaway trainish it feels. I want to sort of wrap it up and give some time frame for the kids around when the deliverable should be completed by.

Finally, Joan considered possible solutions and avenues in which the students could present their learning. The challenge was that many students were preparing PowerPoint presentations and therefore she “can't do a gallery walk if there's a whole bunch of PowerPoint presentations. How do I do a gallery walk and PowerPoint presentation combination? I'm trying to think through that piece”.

Joan mentioned a second inquiry approach she attempted with another class, a group of students with which she works through art curriculum. She became uncomfortable and recalled, “I did try and do a bit of a passion project with art, it did not go well”. She recollected that it was flawed from the beginning as she felt it was too “open-ended”. She asked the students to do
a proposal about what they wanted to do, but she noted they were not able to come up with simple guidelines to questions such as, “how long do you think this would take? What supplies do you need? What are your goals?”. Joan found this process incredibly frustrating as she felt they’ve “not done anything very productive”. She explained that a number of students wanted to paint with acrylics on canvas but because “they just didn't have the skill to do it, they ended up painting stuff that looks really, really primary”. Joan found it further complicated their growth because they were not “proud of their work” and she noted “they would have no sort of vision or plan”. Joan felt very frustrated as the teacher, wanting to help her students but:

They didn't know how to ask for help or say okay ‘I'd really like to do a landscape painting what would be the steps that you would recommend?’ And I would offer, I’d say ‘if you'd like, I'm more than happy to show you some techniques or I can give you some ideas’. No, they didn't want it. Then they would try, but they were so unhappy with their work, they just paint over everything. They would just do a big dot, literally it's terrible. I think they're so unhappy too, but they didn't want to receive any direction.

Joan looked back on her whole experience through the art inquiry and stated, “what I've learned from the whole experience is that I actually think they need more instruction, directed instruction”. She felt their ability to progress was further hindered by the fact that, “there's no pride in what they've done and a lot of wastage of material and supplies”. Joan evaluated the group dynamic and noticed a difference from her homeroom group, in that “a lot of the group is very resistant to learning”. She further explained the composition of the group:

It’s a cohort that has apparently been a challenge since kindergarten and it has grown.

Their challenges have grown throughout the years. New students have joined that group and the students that have joined, all have come with various challenges.
As a new teacher coming into the situation, she wanted to give the students a new start. She noticed an attitude from the group as a whole, that came out clearly was “a huge defense of learning wall, and resistance to learning, and very resistant to risk-taking”. This was a significant difference that she noted between her two groups of students.

**Supports for inquiry.** Throughout her practice, Joan has both modeled inquiry with her students and allowed them to venture into personal inquiry projects. She believed that what allowed students to feel comfortable with their individual inquiry was that “there had been some modeling of inquiry already, but something that was a bit more guided”, which helped the students to scaffold their learning about the process of inquiry. An area that Joan emphasized in her approach to the completion of an inquiry project, and ultimately allowed the students more freedom, was:

Learning isn't over when you do your deliverable, or your PowerPoint presentation. I don't feel like we should ever use the word finished, so maybe we should just think of this [deliverable] as this is what I've learned so far and this is what I'm curious about next. Then they can realize this is something they can continue to build on.

Joan’s top priority for her classroom is that she builds trust with students before she asks them to take risks. As she began with her class at the start of the year, she allowed adequate time and focused on “getting to know the kids, getting to know my own style, getting into the rhythms, and trust… I trust them, they trust me”. She encouraged her students to embody curiosity by asking lots of questions and created “a classroom where the engagement was high”. A supportive environment for inquiry, she recognized, is one that “kids are trusting to be a very safe place”. Joan stated that she knew the class was ready to venture into an inquiry type approach when “the kids engaged in learning…they are growing where ever they are at…and
freely engage in learning and take risks for learning”. Joan also noticed the importance of “building a foundation of knowledge first, so they [the students] had a jumping point to find that area of passion”.

A statement towards the end of Joan’s interview articulated her feelings about being a new teacher, trying new approaches like inquiry and what can potentially help to support inquiry in the classroom: “This year I just need to be able to feel like I have a foundation in the basics of the curriculum, then from that become more creative and how it gets taught”. As Joan navigates her way through her practice, she also noted that she “still struggles with the whole of assessment” but found that within the inquiry co-created criteria, goal setting, and self-assessment supported learning in an inquiry setting: “we co-created the rubric and then they self-assessed on it. They set themselves a goal ahead of time, to make a goal for their learning and they had to reflect on that goal”. Joan noted that her own goal for her professional development is to “take that model [of assessment] into everything I do next year”. Above all else, in order to respond to the needs of the classroom and create an environment conducive to an inquiry approach, Joan stated, “the whole atmosphere in my classroom is engagement in learning, being comfortable with not knowing, and being curious”.

**Common Experiences and Themes between Participants**

In this section I have presented areas in which there was commonality found between the three interview participants’ expression of their experiences. The data collected through the interviews was categorized and coded according to the interview questions. Once the data was separated into the 5 question categories, individual phrases were coded and separated into categories. These categories emerged during the analysis phase based on an in-depth examination of the interview transcripts. Table 3 provides a summary of the categories that emerged within
each interview question and reports the total number of phrases within each category, recorded both by individuals as well as the total responses. The categories are arranged in highest to lowest frequency of total responses, which allows one to notice the phrases heard most often in the interviews as a group and compare the frequency order within individual interviews.

Table 3

*Frequency of responses per question by participants during semi-structured interviews.*

<table>
<thead>
<tr>
<th>Category</th>
<th>Tara</th>
<th>Janet</th>
<th>Joan</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe your inquiry experience and what you valued about participating in an inquiry?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content/comfort</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Uncertainty/feelings</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Start of professional development</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Showed parameters/shift in thinking</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>How did participating in an inquiry help you approach learning in the classroom from an inquiry perspective?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Became student focused</td>
<td>14</td>
<td>4</td>
<td>21</td>
<td>39</td>
</tr>
<tr>
<td>A questioning approach</td>
<td>11</td>
<td>3</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>Change in perspective</td>
<td>13</td>
<td>3</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Guides and/or structures</td>
<td>13</td>
<td>2</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Uncertainty or challenges</td>
<td>16</td>
<td>1</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Threw out status quo</td>
<td>12</td>
<td>1</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>During practicum and/or teaching experiences, how has an inquiry approach been used in your practice?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What it looked like</td>
<td>11</td>
<td>14</td>
<td>18</td>
<td>43</td>
</tr>
<tr>
<td>Content/areas</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>What supports it</td>
<td>9</td>
<td>9</td>
<td>13</td>
<td>31</td>
</tr>
<tr>
<td>Where it appears or is visible</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Conducive to inquiry</td>
<td>7</td>
<td>10</td>
<td>10</td>
<td>27</td>
</tr>
<tr>
<td>Goals</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>What have you found to be the challenge to incorporating inquiry learning in the classroom?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New to inquiry and teaching</td>
<td>13</td>
<td>8</td>
<td>15</td>
<td>36</td>
</tr>
<tr>
<td>Guide for teachers</td>
<td>8</td>
<td>10</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>Age range/skill level/behavior/class size</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>Time</td>
<td>7</td>
<td>2</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Assessment</td>
<td>7</td>
<td>3</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Support</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Goals</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>How have you continued to use an inquiry model for your own learning and further development?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal practice</td>
<td>12</td>
<td>2</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>In practice but not formalized</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Reflection</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Supported by</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>
Although the three participants were at the same time frame in their practice, as they were part of the same cohort and were all teaching full time, their teaching experiences and contexts were very diverse. Tara was teaching in a rural area in two classrooms in two different schools, one of which was a small school focused on inquiry approaches. Janet was teaching in a large urban centre in two classrooms in two different schools, where one of the classes she only taught one day week but had more opportunity with that group to explore inquiry learning. Joan taught in a large urban centre in an independent elementary school, with the majority of her teaching load occurring with one group of students, where she had explored group guided inquiry and individual open inquiry learning.

Several content areas of inquiry exploration were mentioned by all three participants, however all three had explored inquiry approaches within the science curriculum. An interesting connection to the survey responses concerning content areas was participants who reported using an inquiry approach, 86% of those stated using inquiry in science, the highest reported percentage of the topics. Although the three interview participants reflected having used inquiry in science, the three experiences were very different. Tara experienced a whole school inquiry project focused on science in the area of force and motion. Janet used an inquiry approach within a STEM context which offered the students some guidelines around the basis of the scenario, but left the design and solution completely open. Finally, Joan focused the first part of the year teaching the process of inquiry through whole group guided inquiry and then moved into an individual approach, allowing students to choose an area of interest or passion.

A few narratives are found within and across the three participants lived experience of inquiry. A common statement among the three interviewees was the uncertainty of what inquiry looked like or how to “do” inquiry with students, citing being new to the teacher role and also
being new to inquiry. In their experience, because inquiry is a relatively new learning approach and is not widely used, there has been limited opportunity to observe inquiry-based learning in classrooms. All three participants struggled with when to step in to help and when to step out so students could go through the process of discovery. An area that came out clearly across the interview data was their approach to learning in the classroom, which according to the stories shared, focused on a questioning approach and a concentration on student-driven learning. The three teachers spoke of “meeting kids where they’re at”, helping them grow, and allowing them to take “ownership” in their learning.

One narrative that emerged through the stories they shared was a value placed on the idea of and creation of community. Although each participant shared a different context of community, each spoke of valuing and reaching for high engagement from their students and building strong relationships. This is further developed as they shared a desire to create classrooms with trust where students felt safe. This community that they created within their classrooms ultimately enabled students to feel free to take risks, be comfortable with the uncomfortable, and to be resilient following failure. All three shared a different approach to failure, but the commonality was to engage further with the students using questions as a form of support to help students try again with a different approach. The creation of a strong sense of community within their classrooms allowed them to pursue various inquiry approaches with their students because they had laid the ground work for students to feel safe to explore, go deeper, make mistakes and try again.

**Chapter 5: Discussion and Conclusion**

In this chapter I will build on the findings from Chapter 4 in an attempt to draw meaning and connection to the research question from the results of the study. In review, a nested case
study was designed to capture teacher candidates’ understanding and comfort of inquiry, their personal experience within an open inquiry project, and the lived experience as they moved into the classroom and began building their teaching practice. A survey was used to gather data from the last three cohorts in an elementary post degree program, the results of which are presented in Chapter 4. Three participants volunteered to be interviewed to explore their experiences and specifically share their experience of implementing inquiry approaches in the classroom. The experiences of each individual were outlined in the previous chapter and connections were noted between the three participants’ experiences. I turn my attention now to connect the findings in the study with the outcomes towards the research questions which were: 1) What is the effect on a teacher candidate’s likelihood to employ an inquiry approach to science in their classroom following their own participation in an open-inquiry process during their teacher education?; and 2) How does participation in an inquiry process influence a developing teacher’s understanding of teaching and learning?

Effect on the Likelihood to Employ Inquiry

Through the data collected I found that teacher candidates were more likely to employ inquiry approaches, not limited to science exclusively, if four key aspects were experienced during and following their inquiry project within the teacher education program: 1) there was an upset to held values or beliefs about teaching and learning; 2) they experienced a change in disposition towards inquiry; 3) they were able to engage in a professional learning context; and 4) there was value placed on community in and out of the classroom. The next four sections will provide evidence to support the conclusion that the above key areas influence an openness to inquiry and implementation.
An upset to held values and beliefs. As teacher candidates enter a teacher education program they do so with prior beliefs about teaching and learning. If we hope to change teacher candidates’ disposition towards inquiry, we must disrupt what they know and believe about what constitutes solid teaching practice, effective learning, and sound pedagogy (Lee & Krapfl, 2002; Rees et al., 2013). Over half of the participants stated that the inquiry experience changed their approach to learning. This provides a unique opportunity and large potential for change early on within a teacher education program for teacher candidates to significantly shift their approach to learning during their teacher education. The largest subset of participants fell within Group 1, those who were only five months into their 16-month program, and 68% said the inquiry experience changed their approach to learning. With half of the respondents also reporting that the inquiry experience changed their understanding of teaching and learning, there is an opportunity to open and change a teacher candidate’s perceptive on effective ways in which learners engage with material and form knowledge. One of the most difficult stances to affect are deeply held values and beliefs about what constitutes effective teaching methods (Crawford, 2007; Jones & Leagon, 2014) but the first step in changing a teacher’s practice is to upset the status quo and uncover a discomfort with previously held beliefs (Melville et al., 2013). This personal experience with an inquiry approach serves to disrupt previously held ideas about teaching and learning.

Change in disposition towards inquiry. A teacher candidate’s likelihood to employ inquiry approaches was affected by a change in disposition towards inquiry, indicated by an increased comfort with an inquiry process. There was a small change from participants citing a movement from uncomfortable to comfortable through the inquiry experience. However, the largest shift was from those who answered with a “neutral” response during the inquiry
experience about their comfort with the inquiry approach to displaying comfort with the approach, which led to a 14% increase in those who felt comfortable after the inquiry experience. The literature reflects that confidence with content and teaching strategies are significant factors to teachers experimenting and implementing reform-based practices (Lotter, Smiley, Thompson, & Dickenson, 2016; Pilitsis & Duncan, 2012; Rees et al., 2013). In order to change a teacher candidate’s use of innovative practices such as inquiry, their disposition towards inquiry will first need to change (Herrington, Bancroft, Edwards, & Schairer, 2016; Melville et al., 2013; Rees et al., 2013). It is through personal experience and being embedded into an inquiry experience that ones’ conception of this approach to teaching and learning can be affected (Steele et al., 2013).

**Engaged in professional learning.** Teacher candidates who viewed various opportunities during the inquiry project as professional learning opportunities carried that outlook into their practice and affected their desire to implement inquiry strategies. In order to influence the use of inquiry, teacher candidates needed to see the value of the inquiry experience as professional growth. The overwhelmingly positive responses from the teacher candidates about the areas of the inquiry they valued, including 100% of Group 1 (entry point 2018 and still in program) excitement to pursue an area of interest, indicate personal engagement in the process. It is interesting to note that there was a high percentage of positive responses to a number of survey statements concerning the inquiry experience including; overwhelm, discomfort, uncertainty, frustration and enjoyment. The large portion of respondents expressing multiple opposing feelings about the inquiry experience is indicative of the complex nature of both the teaching context and the learning process of inquiry (Lotter et al., 2009). It can be difficult for teacher candidates to process the “messiness” of inquiry from both the teacher’s perspective and the learner’s perspective (Barrow, 2006; Yilmaz-Tuzun, 2008).
When examining the results from Groups 2 and 3 concerning the frustration factor during the inquiry process, it correlates to a much lower percentage than Group 1, only 25% and 38%, respectively. This lower percentage of participants reporting frustration may be due to them being asked to recall an experience which they completed one to two years prior to the survey. During this time, they may have developed a broader perspective or understanding of the process with time and distance from the project and possibly could have decreased some of their initial or raw emotions. Although a high percentage of participants in Group 1 and 2 noted they were encouraged to try an inquiry approach with students following their inquiry experience, a much lower percentage in Group 3 report being encouraged to try inquiry with students, which may be affected by this group now practicing in the field and their personal experiences in their current teaching contexts.

Another area of professional learning identified in the qualitative data having an effect on teacher candidates’ view of and implementation of inquiry was the openness of research approaches within an inquiry context. Teacher candidates enjoyed the variety of ways they were encouraged to obtain information: this approach to gathering information and building knowledge through multiple avenues and multimodal learning is supported in the literature as a personalized approach to learning, which supports learners to engage with material and assess knowledge by a number of different learner-chosen pathways (Bray & McClaskey, 2015). The opportunity for teacher candidates to interview other educators began their professional development role and provided experience with a professional learning network, an idea that links educators, teaching practice, collaboration, and professional teacher development together to affect change in one’s practice (Lotter et al., 2014).
Value placed on community. The final key area connected to a teacher candidate’s likelihood to employ inquiry approaches into their practice is emphasis placed on building community inside and outside their classroom. Inside the classroom the interviews revealed that a critical piece of creating learners who are open to an inquiry process is creating a community within the classroom. The community needs to be one that is a safe space to take risks and make mistakes. The interviewees found their students best responded to and recovered from failure when the teacher modelled how to navigate frustration and resiliency, while also carefully cultivating their choice of language. Successful group inquiry was best displayed when the teacher facilitated collaborative learning to build smaller groups of community within the class community. As they moved beyond their own classroom, the idea of shared community with colleagues and/or administrators was critical in providing a supportive network of professional learning.

Challenges Experienced with Implementation

While examining the areas that increase the likelihood of employing inquiry approaches, it is important to consider the areas that were found to be challenging during implementation which may decrease a teacher’s likelihood to explore inquiry strategies. The challenges experienced by the participants included time, confidence, newness of the strategy, limited experience in a classroom setting, and a full understanding of inquiry itself, which is echoed in the literature (Fazio et al., 2010; Fitzgerald, Danaia, & McKinnon, 2019; Pilitsis & Duncan, 2012).

The overall underpinning to the challenges the teachers faced when implementing an inquiry approach centered around the sense of newness of the teaching role and the inquiry approach. There was a desire to have a “how to” kit to help guide the inquiry process when
working with students. However, the purpose of inquiry is to contemplate the big questions, taste the uncomfortable, experience the mishap, and sit with the not knowing; there’s no way to put that into a kit. When definitions and categories are placed on strategies for engaging learners, teachers will focus on getting it right and therefore be less likely experiment, because they want their learners to be and feel successful (Dobber et al., 2017; Turcotte & Hamel, 2016). If we want teachers to employ reformed-based practices in their classrooms we need to provide them opportunities to experience the not knowing, get comfortable asking more questions rather than giving answers, and removing the philosophy that there is a right way to “do” inquiry.

Finally, assessment appeared to hinder teacher candidates from embracing an inquiry approach. An alternative assessment method from the standard grading system within the university was used to assess the inquiry project, which focused on formative feedback and categorizing the project as either having met the professional standard or required improvement. Despite personal experience with an alternative feedback system, participants struggled to transfer their experience into the classroom. They struggled with how and exactly what to assess, as they found it difficult to assess their learning process during inquiry and their gained knowledge as the content in open inquiry differed from student to student. A major barrier to teachers incorporating inquiry approaches to learning centred around uncertainty of assessment of an inquiry result, strong beliefs about assessment, and deeply entrenched evaluation practices (Fazio et al., 2010; Fitzgerald et al., 2019).

**Influence on Understanding of Teaching and Learning**

The second area explored during this study was concerned with how the participation in an inquiry experience influences a developing teacher’s understanding of teaching and learning. The findings revealed that, through an inquiry experience, a teacher candidate’s understanding
was influenced in three ways: 1) it challenges their concept of learning; 2) it challenges their ideas about the role of the teacher; and 3) it changes their language of learning. Using the data collected and previous research, the next three sections will offer evidence in support of the above influences on the understanding of teaching and learning following an inquiry experience.

Challenging their concepts of learning. Teacher candidates enter a post degree teacher education program having been successful academics students, having already achieved an undergraduate degree, most of whom will have experienced primarily teacher-directed learning scenarios. Following a single inquiry experience 83% of respondents were encouraged to try an inquiry approach with students. Participants also connected concepts of personalized learning to an inquiry approach. The teachers in the study placed a high value, within their practice, on student-focused and student-driven learning, which they saw as a critical component in achieving an inquiry approach to learning. Reform-based practices serve to upset the traditional teacher-directed model and personally experiencing approaches such as inquiry contain the potential to significantly alter held concepts of learning as evidenced in this study.

Teacher candidates were influenced by their participation in an inquiry project by experiencing both a change in the understanding of teaching and learning and a change in their approach to learning. Several of the teachers in the study reported using inquiry approaches in their practice and attributed the inquiry project in their program to changing their approach to teaching. It is important to acknowledge that this inquiry project may not have been the only influence on their implementation of this approach, however the respondents in the survey cited the project in the study as the influence that changed their understanding and approach to learning. Group 1 had the highest percentage, 64%, reporting a change in their approach to learning. With 64% of the participants stating that the inquiry project changed their approach to
learning, and the project occurring within the first four months of the program, this provided the potential for significant change in a teacher candidates’ previously held beliefs about learning.

In order to change a teacher candidate’s approach to learning, they need to first experience change or growth in their understanding of learning, which may serve to unsettle prior conceptions of learning. There appears to be a connection between a teacher candidate experiencing a change in understanding and a change in their approach to learning; of the 12 respondents who identified a change in understanding, 11 went on to experience a change in approach to learning. Similarly, of the six who did not express a change in understanding, five went on to experience no change in approach to learning. As the teachers were tracked further into their teaching practice, six of the respondents from Groups 2 and 3 who identified experiencing a change in understanding and approach to learning, five identified the inquiry experience as having an effect on their approach to teaching and are currently implementing inquiry approaches in their practice. Although the sample size is small, these data suggest that providing a personal experience with inquiry in their teacher education program may support teacher candidates to try an inquiry approach to teaching in their classroom later on. This potential for change points to the importance for teacher education programs to provide personal experiences with inquiry and reform-based practices. If teacher candidates change their thinking about their own learning, they may be able to transfer that new understanding to better comprehend their future students’ learning and therefore be open to exploring new approaches to teaching.

**Challenging their ideas about the role of the teacher.** Participating in an inquiry project influences a developing teacher’s understanding of teaching by challenging or adjusting their ideas about the teacher role in an inquiry scenario. As seen in Figure 8 (pg. 44), an
interesting trend shows very strong responses, both positive and negative, towards a group of questions. What was surprising was the large number of neutral responses when faced with the statements that “the teacher is irrelevant in inquiry” and that “inquiry can be used if led by a teacher”, indicating an uncertainty about the role of the teacher during inquiry. Although participants felt inquiry could be used in a whole class setting, all three interview participants commented on their struggles of how to “do” inquiry with a whole class and talked about the challenges with knowing where to start with inquiry when using it within a classroom of children. Questions around the participants’ understanding of inquiry and the process of inquiry highlighted what was also found in the literature; there are still many uncertainties about inquiry and strategies using inquiry approaches (Capps & Crawford, 2013b).

The role of the teacher within an inquiry continues to challenge new and experienced teachers (Dobber et al., 2017). The interviews shed light on the challenges that teachers face when navigating their role within an inquiry approach. The teachers questioned where to insert themselves or step back from the inquiry, in order to allow learners the freedom to explore and experience discovery learning, even if that meant the students became frustrated. They struggled with structural supports to inquiry, questioning where and how to scaffold, and where to put boundaries to make the inquiry manageable, which has also been cited in the literature (Capps & Crawford, 2013b; Dobber et al., 2017; Turcotte & Hamel, 2016). They grappled with open inquiry versus guided inquiry, how much was too much guidance, and what supports needed to be in place for open inquiry to be successful. Each interviewee spoke to the importance of understanding the different needs at different ages, how their own role differs with different ages and the different needs at the beginning of the year versus the end of the year (Crawford, 2014). Exploring these challenges to one’s teaching practice and the changing role within inquiry allows
a developing teacher’s confidence to grow, in both their skill development and their comfort with the uncomfortable.

**The language of learning.** Within the qualitative data, it was found that participation in the inquiry project influenced the teacher’s language surrounding learning. The interview phase of the study provided a rich lens into how new teachers are navigating their way through incorporating inquiry learning into their practice and into their classrooms. The three teachers interviewed described three different approaches to inquiry; one was a whole school project, one was group based and guided in one subject, and the third was an individual open project-based inquiry. However, I found a commonality in their experiences throughout the process. Their teaching practice and approach to learning formed around two principles -- using a language of questions to engage students and focusing on student-centred learning, both of which are key pieces to inquiry and personalized learning (Bray & McClaskey, 2015).

A theme that emerged was centred around the language used in order for a classroom and learners to be open to inquiry. A critical piece to ensuring classrooms are safe spaces for inquiry and risk taking is the teacher’s intentionality with their words around the ideas of “getting it right” and “failure”. The teachers in the study created spaces where students felt safe to make mistakes and that the teacher valued their exploration. Also embedded in their practice was the idea that inquiry doesn’t end or finish, but the language we choose to use with students at the “end” of an inquiry is important for their understanding of an inquiry approach. The foundation of inquiry is the ability to ask questions and explore those wonderings, while continuing to ask questions along the way. It seems fitting that the end of an inquiry would spark the learner’s next question.
Unexpected Findings

One of the unexpected findings in the study was the lack of connection between full time teaching and the use of inquiry. I had expected to find that those who worked in full time positions may be more likely to explore inquiry learning approaches, however, there did not appear to be a correlation. The teachers in the study included four newly certified teachers and eight teachers approximately one year into their practice. All twelve of the participants are working as teachers; four full time, six holding a mix of teacher-on-call (TOC) and contract work, one TOC and one working outside the K-12 system. While working with the interview participants, all working full time contracts, it became clear that the definition of full time needed to be more clearly identified in the survey. Although the 3 interviewed teachers were working at a full-time capacity; one was full time in a single classroom, the other two were full time equivalent through two part-time continuous contracts. This created ambiguity about the definition of full time. There did not appear to be a correlation between teaching full time and the use of inquiry, as the four full time respondents in the survey, two reported using inquiry and of the six mixed part time contract respondents four report using inquiry.

Science and cross curricular contexts appeared to be the most common subject areas where inquiry was being used. These results were observed in both the quantitative and qualitative findings. I had expected the use of inquiry in science to be lower based on the low number of participants who entered the teacher education program with undergraduate degrees in science, which I predicted would lower their confidence with the science content (Rees et al., 2013; Steele et al., 2013). One limitation of the study is that I don’t know if the teachers were actually doing inquiry, as classroom observations were not part of the methods. The teachers may be associating hands-on with inquiry, but may not be employing the critical pieces of inquiry,
which Slavin (2014) describes as the student taking the lead in their learning and building a depth of understanding. However, based on the interviewees’ descriptions of their students’ inquiry experiences in their classrooms, I would conclude that one of them was using guided and open inquiry and two of them were using guided inquiries, where the teacher provided the general topic of study but the students took on the inquiry phases of design, problem solving, critical thinking and presenting the learning. It is interesting to note that one of the interview participants didn’t know if she was using inquiry, still feeling unsure about the approach itself and how to use it, which has been found in the literature to be a hinderance to teachers embracing an inquiry approach (Crawford, 2014; Lustick, 2009). As she described her classroom practice and her experiences with her students, I realized that she was using inquiry approaches (in science and other areas) successfully and she shapes her teaching practice around a questioning approach, therefore leading her students to inquiry type thinking (Barrow, 2006; Bray & McClaskey, 2015).

Finally, it is important to consider other contributing factors which may have influenced the use of or incorporation of inquiry into the teacher candidates’ practice. Within the survey, for those who said they were using inquiry, 86% stated using inquiry in science and 71% in cross-curricular contexts. As noted above, all three interview participants were using inquiry in science and two were using inquiry through cross-curricular contexts. It is surprising that ‘fine arts’ was one of the lowest reported contexts where inquiry was being used, given that the fine arts appears to be a subject in which project-based learning and personal interest would be a large focus for these areas. The high percentages reported for science and cross-curricular may have also been influenced by other experiences in the program. For example, a focus on inquiry approaches to science in the science curriculum and instruction course might have contributed to the teacher
candidates’ building of strategies or comfort with an inquiry approach in that subject area (Crawford, 2007; Dobber et al., 2017; Fazio et al., 2010; Windschitl, 2003). A programmatic focus or value being placed on cross-curricular approaches in various courses within the program might have also influenced their implementation of inquiry through a cross-curricular context.

**Implications and Limitations**

A condition of this study is that the findings are not generalizable but they are valid. The study tracked the experience through an inquiry process of 26 teacher candidates and the lived experience, by 3 new teachers, of moving inquiry into the classroom. Every experience through an inquiry process is going to be different and personalized. Teacher candidates need time to experience an inquiry approach and be able to reflect on that experience. It is not a generalizable concept; however, it may carry significant impact on teacher education programs and their program design. There is not a statistical model within this scale of a study, therefore causality cannot be claimed, but the goal was to gather information on the effects of an experience and the implications on a developing teacher’s practice.

A limitation of this study and area to consider for further develop should the study be conducted again, would be to gather more information about the background of the participants. Although the survey identified information about past inquiry experiences and prior degrees, because the survey was anonymous and blinded from the interview participants, I was unable to connect that data to the interviewees. The interviews provided a rich lens into the teachers’ experience in the classroom and there could be an opportunity to look at the sociocultural history and connection to their current practice, had that collected data been connected to the interviewees. If the study were conducted again, it would be interesting to explore further the impact of background, past experience, history, and context on the teaching practice.
A consideration and limitation to the study is to recognize that the inquiry experience being examined is not the only factor affecting the outcome. In this nested case study, the variable of time may have affected the comparable experiences between the three groups. When we explore the lived experience, the factors that will affect each individuals’ lived experience are varied. However, the purpose of the study was to gather the lived experience and map out a teacher candidate’s journey from inquiry to classroom. In doing so, the learning from this study has significant implications in pre-service teacher education programs, if they aim to immerse teacher candidates in authentic inquiry experiences at the beginning of their journey to becoming teachers.

**Future Research**

There are several possibilities for future research following this study. This study has only touched on the entry into pre-service teacher education and into the first year of a teacher’s practice. A longitudinal study over the course of several years could highlight key factors needed for new teachers to successfully implement inquiry-based practices. Further study is needed with teacher candidates as they enter a teacher education program, tracking their experiences through the program and through practicum placements in order to investigate the impact of inquiry approaches during field experiences. Following newly certified teachers into the early stages of their practice provides an enormous potential for continued professional learning of the teacher and gathering strategies for influencing teacher education programs.

The current study uncovered the importance placed on the support offered by administration on inquiry implementation. An area that could be further explored is the role of leadership and the effect of school and district leadership on inquiry in the classroom. Within the concept of continued professional development, the effect of mentorship to new teachers by peer
colleagues using inquiry provides an opportunity for institutions and field partners to collaborate. This collaboration could also serve to better connect teacher education programs and the world of classroom teaching. This study has identified the importance of early exposure to an inquiry experience in a pre-service teacher education program. The inquiry experience in this case study was designed around a teacher inquiry format but further exploration could look at the next stage of the practice of inquiry, by incorporating students and the factors that affect implementation into the classroom.

**Conclusion**

This thesis aimed to contribute to the body of research concerning developing teachers, their personal experience with inquiry and their use of inquiry approaches in the classroom. In order to meet this aim, the thesis drew on the theoretical framework of constructivism and research from science education, pre-service teachers and inquiry, to explore through a nested case study, the impact of participation in an open inquiry has on a teacher candidate’s likelihood to employ inquiry approaches to science in the classroom, which was broadened to include inquiry strategies within other curricular areas based on the participants’ experiences shared during the study. Results suggest that there is an increased likelihood of teacher candidates using inquiry approaches if their personal experience with inquiry serves to unsettle held beliefs, changes their disposition towards inquiry, allows them to engage in professional learning, and highlights the value of community. Furthermore, participation in an open inquiry appears to influence their understanding of teaching and learning by leading to a change in approach to learning, challenging their notions of the teacher role, and creating a new language of learning. From the findings, it could be concluded that early personal experiences with inquiry in a teacher education program can provide teacher candidates the opportunity to significantly shift their
understanding of teaching and learning needed to employ reform-based practices such as inquiry. If teacher education programs hope to provide a space where this shift can take place, there will need to be an intentional programmatic focus on unsettling previously held beliefs about teaching and learning.
Reference List


Toronto, Canada: Thompson Educational Publishing.


Lee, C., & Krapfl, L. (2002). Teaching as you would have them teach: An effective elementary


## Appendices

### Appendix A: Research Timeline

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Appendix B: Survey Questions

**Online Survey to be used for the study (order subject to change):**

For all participants:

- Please check which year you entered the Teacher Education Program:
  - Sept. 2018
  - Sept. 2017
  - Sept. 2016

- Prior to entering the Teacher Education Program where have you had experience with inquiry learning? Check all that are appropriate.
  - I had experience with inquiry learning through my post-secondary degree
  - I had experience with inquiry learning during high school (8-12)
  - I had experience with inquiry learning during elementary school (K-7)
  - I had experience with inquiry learning outside of formal education contexts
  - I cannot remember having any experience with inquiry learning situations

- Prior to entering the Teacher Education Program how would you describe your experience during any inquiry learning?
  - Exciting
  - Frustrating
  - Allowed me to pursue an area of interest important to me
  - Uncomfortable with openness of inquiry approach
  - I cannot remember having any experience with inquiry learning situations

- **During the process** of inquiry in EDCI 360 Link2Practice, I would describe my feelings as: (Mark on the scale from Strongly Agree to Agree to neutral to Disagree to Strongly Disagree)
  - Excited to pursue an area of interest
  - Overwhelmed with getting started
  - Grateful for allowing me to connect with other educators
  - Uncomfortable with the openness of an inquiry approach
  - Uncertain when the inquiry question was answered or finished
  - Enjoyment in the process
  - Frustrated with the process

- **After participating** in the inquiry project as part of your seminar class in the first term of your Teacher Education Program: how would you describe your feelings of inquiry: (Mark on the scale from Strongly Agree to Agree to neutral to Disagree to Strongly Disagree)
o I feel confident to take on my own inquiry
o I am encouraged to try an inquiry approach with students
o I see value in an inquiry approach to science curriculum
o I see value in an inquiry approach to humanities curriculum
o An inquiry approach has changed my understanding of teaching and learning
o Inquiry is uncomfortable
o I do not know how to incorporate inquiry into a classroom setting

• Having participated in an inquiry project how would you describe your understanding of inquiry: (Mark on the scale from Strongly Agree to Agree to neutral to Disagree to Strongly Disagree)
  o Inquiry is a learning strategy
  o Inquiry is a teaching strategy
  o Inquiry is used for learners to explore an area of interest
  o An inquiry approach is only useful as a personal project not a whole class application
  o Inquiry allows learners to go deeper into an area of study
  o An inquiry approach can be used in a classroom if led by the teacher
  o The teacher is irrelevant in an inquiry project

• Did participating in an inquiry help you approach learning differently? Explain. (open response)

BREAK: If participant checked 2018 above, this is the end of the survey

If you checked that you started the Teacher Education Program in Sept. 2016 or 2017, the following three questions are open to you:

• Have you used an inquiry approach to learning in your teaching practice?
  o Yes
  o No

• If you answered yes to the previous question, what subjects or contexts have you incorporated inquiry learning? Check all that are appropriate.
  o Humanities
  o Sciences
  o Math
  o Fine Arts
  o Other: ________________________________

• Did participating in an inquiry help you approach teaching differently? Explain. (open response)
Appendix C: Interview Questions

**Interview guide to be used for the study:**

**Demographic Gathering:**

The interview session will begin with general questions to gather some information about the participants' background and teaching experience:

- What year did you graduate with your Bachelor of Education?
- What was the context of your teaching practica? Grade? Geographical location?
- What has been your teaching experience since completing the program?
- Tell me about your inquiry project that you completed in the Teacher Education Program.

**Interview Questions:**

- Before you began your teacher education, what was your understanding or experience with inquiry?
- Did you value participating in a personal inquiry project? Why or why not?
- Did participating in an inquiry help you approach learning in the classroom from an inquiry perspective?
- During practicum and/or teaching experiences, how has an inquiry approach been used in your practice?
- What have you found to be the challenges to incorporating inquiry learning in the classroom?
- Have you continued to use an inquiry model for your own learning and further development?
Appendix D: Recruitment Script

Email Script for Recruitment

Hello Teachers and Teacher Candidates,

You are being invited to participate in a study entitled *A teacher candidate’s journey through inquiry and into the classroom* that is being conducted by Dana Bell, a graduate student and teacher educator in the department of Curriculum and Instruction at the University of Victoria.

The purpose of this research project is to discover the impacts of teacher candidates participation in an inquiry project. The research aims to uncover whether participating in a personal teacher inquiry has an influence on a developing teacher's practice and approach to teaching science.

You are being asked to participate in this study because you experienced a teacher inquiry process as part of your teacher education at the University of Victoria. If you agree to voluntarily participate in this research, this will include completing an online anonymous survey taking approximately 8 minutes to complete.

Your participation in this research must be completely voluntary. Initial contact for requesting your participation has been sent by a third party and therefore the researcher is unaware of participants in the study. There is no academic, financial, or professional consequence linked to your participation. If you decide to participate, you may withdraw at any time without any consequences or explanation.

If you would like to participate, click on the link below to the online anonymous survey.

Thank you.
Appendix E: Survey Cover Letter for Implied Consent

Research Project Title: A teacher candidate’s journey through inquiry and into the classroom

You are being invited to participate in a study entitled *A teacher candidate’s journey through inquiry and into the classroom* that is being conducted by Dana Bell, a graduate student and teacher educator in the department of Curriculum and Instruction at the University of Victoria.

The purpose of this research project is to discover if there are lasting effects on teacher candidates participating in an inquiry project. The research aims to uncover whether participating in a personal teacher inquiry, exploring an aspect of education or educational practice, has an influence on a developing teacher's practice and approach to science.

Research of this type is important because it will explore whether or not a personal experience with inquiry as a learner has an influence on a developing teacher's attitude and approach to science and whether or not the approach is incorporated into their practice.

You are being asked to participate in this study because you experienced a teacher inquiry process as part of your teacher education at the University of Victoria. If you agree to voluntarily participate in this research, this will include completing an online anonymous survey.

Your participation in this research must be completely voluntary. If you decide to participate, you may withdraw at any time without any consequences or explanation. If you withdraw from the study, the anonymous survey data cannot be retrieved.

The researcher may have a relationship to potential participants as they are participants or graduates of the Teacher Education Program. To help prevent this relationship from influencing your decision to participate, the following steps to prevent coercion have been taken; initial contact for requesting your participation has been sent by a third party and therefore the researcher is unaware of participants in the study. There is no academic, financial, or professional consequence linked to your participation.

Your anonymity and confidentiality will be protected by the use of an anonymous on-line survey. For those who have graduated from the Teacher Education Program, there will be an opportunity to volunteer for the interview portion of the study, through an external link in the survey which will not be linked to the participants’ responses in the survey. It is anticipated that the results of this study will be shared with others in conferences and presentations, and through the publication of a thesis, and online through ‘UVicSpace’.

Primary data from this study will be disposed of in three years from collection date. Following the completion of the thesis presentation electronic data will be erased and any paper documents will be shredded. You may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your completion of the following survey indicates that you understand the above conditions of participation in this study and that you consent to participating in the survey portion of the study.
Appendix F: Research Consent for Interview

A Teacher Candidate’s journey through Inquiry and into the classroom

You are being invited to participate in a study entitled A Teacher Candidate’s journey through Inquiry and into the Classroom that is being conducted by Dana Bell.

Dana Bell is a graduate student and teacher educator in the department of Curriculum and Instruction at the University of Victoria and you may contact her if you have further questions by email: dgbell@uvic.ca.

As a graduate student at the University of Victoria in the Faculty of Education, I am required to conduct research as part of the requirements for a degree in Master’s of Education, Educational Studies. It is being conducted under the supervision of Dr. Todd Milford. You may contact my supervisor at 250-721-7808.

Purpose and Objectives The purpose of this research project is to discover if there are lasting effects on teacher candidates participating in an inquiry project. The research aims to uncover whether participating in a personal teacher inquiry, exploring an aspect of education or educational practice, has an influence on a developing teacher’s practice and approach to science.

Research of this type is important because it will explore whether or not a personal experience with inquiry as a learner has an influence on a developing teacher's attitude and approach to science and whether or not the approach is incorporated into their practice.

You are being asked to participate in this study because you experienced a teacher inquiry process as part of your teacher education. If you agree to voluntarily participate in this research, this will include completing an online anonymous survey (already complete) and a 30 minute interview, at the University of Victoria. You will also have the opportunity to share documents outlining your classroom experience with an inquiry approach to learning and teaching.

The interviews will be set at a convenient time for participants, given work schedules, between the dates of February 1 and March 30, 2019.

There are no known or anticipated risks to you by participating in this research. The potential benefits of your participation in this research include your professional development of further understanding inquiry and the continued development of a reflective practice. The wider context is allowing your experience through inquiry to benefit emerging educators as well as the learners with which you work.

Your participation in this research must be completely voluntary. If you decide to participate, you may withdraw at any time without any consequences or explanation. If you withdraw from the study, your interview captured data will only be used if participant gives permission.

The researcher may have a relationship to potential participants as they are graduates of the Teacher Education Program. To help prevent this relationship from influencing your decision to participate, the
following steps to prevent coercion have been taken; initial contact for requesting your participation has been sent by a third party and there is no academic, financial, or professional consequence linked to your participation.

Your confidentiality and the confidentiality of the data will be protected by the use of pseudonyms in the presentation of the data. It is anticipated that the results of this study will be shared with others through the publication of a thesis, scholarly presentations and online through ‘UVicSpace’.

Data from this study will be disposed of following the completion of the thesis presentation by erasing electronic data and shredding any paper documents collected.

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researcher.

_____________________________
Name of Participant

_____________________________
Signature

_____________________________
Date
Appendix G: Ethics Certificate of Approval

Certificate of Approval

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PROJECT TITLE Tracking teacher candidates’ journey through inquiry into the classroom

RESEARCH TEAM MEMBERS None

DECLARED PROJECT FUNDING None

DOCUMENTS INCLUDED IN THIS APPROVAL
Revision Table.docx - December 18, 2018
Implied Consent Survey Cover Letter Dec. 18 Version 2 Dana Bell.docx - December 18, 2018
Research Consent Dec. 18 Version 2 Dana Bell.docx - December 18, 2018
Survey Questions Dec. 18 Version 2 Dana Bell.docx - December 18, 2018
Interview Questions Dana Bell.docx - November 23, 2018
Email Script for Recruitment.docx - November 23, 2018

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a “Request for Modification” form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a “Request for Renewal” form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a “Notice of Project Completion” form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlines by the University of Victoria Research Regulations Involving Human Participants.

Dr. Rachael Scarth
Associate VP Research Operations

Certificate Issued On: 2018 Dec 19