PARTICIPATION IN AN EXPERIENTIAL EDUCATION PROFESSIONAL DEVELOPMENT COURSE: AN ANALYSIS OF THE TEACHER EXPERIENCE

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Abstract

Experiential education opportunities are recommended in science classrooms but due to budget and time constraints (Cowart, 2010; Dallimore, et al., 2010; Johnson, 2007) schools often resort to simple science inquiry (Chinn, 2002). While many programs exist with the intention of providing teachers with experiential education opportunities, often these are short-term day trips that do not provide the same learning benefits that an extended program would (Gulamhussein, 2013). To help address these issues in their own classrooms, middle and high school teachers from New England voluntarily chose to participate in an experiential education professional development course. This study examined how the individuals’ teaching had or had not changed as a result of their participation in this course. The question that guided this research was:

• How do teachers benefit, and how do teachers perceive their students benefit, after their participation in an experiential education professional development course?

Research focused on teachers from middle and high schools across New England who completed a three-day program. Their participation in the course was entirely voluntary. The course goal was to provide teachers with the skills to be able to understand and apply experiential education pedagogy and principles in their classrooms. This interpretative phenomenological analysis found that all participating teachers had made changes to their curriculum and teaching methodologies as a result of their participation in the professional development course. While the experiential learning model (Kolb, 1984) played a significant role how the professional development was implemented during the professional development course for teachers, only portions of the experiential learning model were present when teachers implemented those lessons into their own classes. Regardless, teachers found that students had
been impacted through the engagement they felt and the connections they made to their field-based place of study, and all teachers felt compelled to change their courses to incorporate the watershed curriculum due to its relevance for students.

*Key words: experiential education, experiential learning, experiential learning model, professional development*
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Chapter One: The Research Problem

Purpose of the Study

The purpose of this study was to perform an interpretative phenomenological analysis (IPA) of teachers’ experiences following their participation in a professional development course designed to help teachers apply inquiry-based learning into their classroom curriculum. This study sought to answer the question: How do teachers benefit, and how do teachers perceive their students benefit, after their participation in an experiential education professional development course?

The purpose of this study was to perform an IPA using principles established by Smith, Flowers and Larkin (2009). This IPA examined the experience of teachers who participated in an experiential education professional development (EEPD) course as a means to understand the impacts of the course on its participants. This study serves to provide greater understanding of how teachers may use such an experience to alter their method of teaching as a result of their participation.

Problem and Significance

Experiential learning is “the process whereby knowledge is created through the transformation of experience” (Kolb, 1984, p. 38). This method of learning through experience has been explored and touted by many in the education field (Duggan & Gott, 2002; Ewert & Sibthorp, 2009; Hinojosa, 1996). Experiential education is a “... process or method that can be used to teach” (Adkins & Simmons, 2002, p. 38), and has been somewhat intertwined with the terms “learn by doing” and “hands on learning” (Roberts, 2005). While not all hands-on learning experiences can be categorized as true experiential learning opportunities (Roberts, 2005) these
terms have come to give common language and understanding to the process of experiential learning and education.

Inquiry-based learning is a form of experiential learning, as it is developed based on the ideas from the experiential learning theory (Healey, 2005). Inquiry-based learning is defined by the National Science Foundation as “an approach to learning that involves a process of exploring the natural or material world, that leads to asking questions and making discoveries in the search for new understandings” (2000, p. 1). Inquiry-based learning has come to be valued as an effective way for students to learn science, and teachers have been encouraged to embrace inquiry-based teaching and promote it in their classroom (Brown, 2006). State standards have begun to require the usage of inquiry-based methods in the classroom. This can be seen within the Massachusetts State Frameworks for Science Education, as designated by the MA Department of Education (2006). They state that inquiry, experimentation and design should arise from the science curriculum (p. 9). “Students should have curricular opportunities to learn about and understand science and technology/engineering through participatory activities, particularly laboratory, fieldwork, and design challenges” (2006, p.9). Massachusetts State Frameworks have identified the need to incorporate a more hands-on approach to science learning for the benefit of Massachusetts’s public school students.

The Massachusetts Department of Education has not been the only organization to implement a move toward a more inquiry-based approach. Of national relevance are changes to the College Board’s Advanced Placement science courses (2011). Key objectives for the AP Biology course include the need to emphasize scientific inquiry and student directed labs (2011). There is an understanding that students benefit from an inquiry-based approach.
The experiential learning model (Kolb, 1984) stresses the importance of experience and reflection, while also requiring the participant to be active in their learning, and these, along with the experience requiring meaning and relevance for the learner, are the definition of an experiential education (Dewey, 1938, Crosby, 1981, Joplin, 1981, Kolb, 1984). Inquiry-based learning identifies the process of learning by the active participant in the effort to make new discoveries (National Science Foundation, 2001). The experiential learning model (Kolb, 1984) identifies both the process of learning through inquiry-based means and the components of an experiential education within that process (as defined above). Therefore this study will discuss both inquiry-based learning and the tenets of experiential education throughout this study.

While there appears to be much attention paid to the importance and value of inquiry-based learning opportunities in the classroom, there are many barriers that prevent educators from having the ability to provide such learning opportunities for their students. Johnson (2007) asserts that reasons such as lack of preparation time, classroom management issues, assessment ability and mess cause teachers to avoid inquiry-based learning methods (p. 49). Similarly, Allison and Wurdinger (2005) list five barriers to inclusion of experiential learning as assessment ability, control, time, student numbers, and systemic problems (p. 89). Another potential reason for a lack of experiential learning in the classroom may stem from the level of confidence the teachers have in themselves. Johnson discusses the point that very few teachers have an understanding for how to teach science as it is found in the real world, and instead resort to memory and recall exercises (2007). It is to be assumed that if some of these barriers can be overcome, there may be more opportunity for experiential learning to occur in the classroom. While many teachers may want to improve their skills, it has been found that most teacher professional development is ineffective and does not change the teacher’s practice or improve
student learning (Gulamhussein, 2013).

Teachers in this study participated in an experiential education professional development course designed to address some of the identified barriers to experiential learning often seen in the classroom. Upon completion of the course they were required to develop a meaningful educational experience and field trip to conduct during the school year with their students. During the training, teachers had also been given the opportunity to discuss some of the other barriers to implementation, and the course promoted ways to overcome them within the group (N. Scola, personal communication, December 16, 2011).

**Practical and Intellectual Goals**

Professional development (PD) courses are offered to teachers as a means to improve the classroom experience for their students, but most professional development courses show no student improvement whatsoever as a result of teacher participation (Gulamhussein, 2013). Lacking in areas such as duration of the PD, engagement of teachers during the PD, support for teachers, modeling and content specificity, most professional development falls short (Gulamhussein, 2013). To compound the issue, teachers believe their voices are not being heard when it comes to making changes that benefit education: “. . . teachers feel like they don't have a voice in their districts and at the state and national levels about what is happening in their schools and classrooms” (Weingarten, R., 2014). Since teachers work most directly with students it is imperative that they be included in the conversation. Thus the problem of practice identified in this study is the need for professional development that is impactful and promotes science learning in the classroom.

Teachers in this study chose to participate in a PD course that encouraged them to take class trips into the local environment and to implement experiential education lessons connected
to their field experience into their classroom activities. This research analyzed the teacher experience after they participated in this experiential education professional development (EEPD) course and sought to understand what ways the teachers’ practice has changed as a result of their participation. It used interpretative phenomenological analysis methodology described by Smith et al. (2009) to guide the research, and may serve as a means to further understand the impacts of an EEPD on its teacher participants.

Brief Summary of the Research Question

This study sought to understand how teachers benefitted, and how they perceive their students benefitted, after their participation in an EEPD course. The specific research question for this study will be:

• How do teachers benefit, and how do teachers perceive their students benefit, after their participation in an experiential education professional development course?

Theoretical Framework

Teachers in this study voluntarily sought out a summer experiential education professional development (EEPD) course in which to participate that provided them with the opportunity to better understand how to provide an experiential learning opportunity for their students. For the purposes of this study, experiential education theory, (Dewey, 1938) and experiential learning theory (Kolb, 1984), will act as lenses for this IPA, due to the nature of both theories and their connections to this type of EEPD course in which the teachers have chosen to participate.

Experiential education is an approach through the development of relationships between the individual, the teacher and the environment that can lead to knowledge (Bell, M., 1993, Itin, 1999, Kolb, 1984, Quay, 2003). Experiential education theory centers on the direct experience
and focused reflection of the student (Joplin, 1981), and requires the student to be an active participant in his or her learning. In order for students to be most successful they must also have the components within that learning experience that will allow for learning to take place.

Experiential learning theory addresses the process required for learning to occur and relies upon the action and reflection for transformation of knowledge and learning to occur (Kolb, 1984). This process will be explored through the experiential learning model designed by David Kolb (1984).

It is important to incorporate both the experiential learning theory and experiential education theory into this research. Together they wholly encompass the experience of the teacher, both as a mentor, guiding and encouraging experiential learning for their students, and as a learner, gaining knowledge and understanding for the process of how to implement experiential education in the classroom. Both theories are complementary and therefore necessary for this study.

**Experiential Education Theory**

John Dewey (1938) helped to define experiential education and has been a guiding theorist for many in the field of experiential education (Beard & Wilson, 2006, Smith & Knapp, 2011, Warren, et al., 2008). John Dewey was somewhat transformational through his identification of problems he saw with the American school system, and his identification of key differences between the traditional and progressive experiential classroom (1938). In working to address educational concerns, one method he purported for improvement was that students should be active participants in the process of learning (Dewey, 1938). Experiential education theory centers around the concept that students must be actively engaged in their learning in order to have an effective educational experience (Itin, 1999, Lindsay and Ewert, 1999,
Proudman, 1992). An educational experience must be structured in such a way to require that the student “take initiative, make decisions and be accountable for results” (Zarrella, 2011, p. 241). It is important that the teacher promotes and encourages the connection between the student and the subject matter, and keeps the connection between the two alive (Bobilya and Daniel, 2011). Crosby states that “… learning will happen more effectively if the learner is as involved as possible, using as many of his faculties as possible, in the learning…” (1981, p. 10).

Paulo Freire was an advocate for the active student learner, and has been considered by some to be pivotal in the development of experiential education theory, as his work spoke to address what he saw as some of the obstructions to education (Itin, 1999). Freire (1970) is well known for his discussion of the “banking model of education,” in which he spoke about the student as a bank depository receiving the information provided by the teacher with little analysis or discussion. Students in this manner are merely passive participants (p. 72). He felt strongly that this type of education was ineffective, and that knowledge is developed as students create it, rather than receive it. He believed in the use of dialogue instead of primarily teacher-led discussions to engage both parties in what was known and unknown, in the effort to promote a transformation of reality (Estes, 2004). In promoting student empowerment, teachers must encourage students to take control of their own learning in order to make the learning experience active on the learner’s part and more meaningful overall (Estes, 2004).

In order to promote student learning through experience, an educator must seek out experiences that have meaning for the student (Dewey, 1938). Teachers have an obligation to help students consider the real world connections to the information they are learning (DeLay, 1996). Itin (1999) asserted that learning can only take place if the material and context have real world applications to the learner. Dewey felt that a learning experience must account for the
student’s previous experiences while also including the intended outcome, and as such, could not occur in isolation (Breunig, 2008).

Dewey contended that the traditional schooling methods did not support the type of learning that would be conducive for students to recognize relevance in their learning. He felt that students should be taught in a manner that connected and engaged them in real world, but found instead traditional schooling to be at odds with this notion. Dewey described it as a “basic schizophrenia in education in a society that claimed to value freedom, democracy, self-direction and personal responsibility” (as cited in Hunt, 1981, p. 210). Many of these same issues have been seen in contemporary learning environments (Beard and Wilson, 2006), and many EEPD programs have sought to bridge some of the incongruences of which Dewey speaks.

Dewey identified two key principles that further define the learning process, those of continuity and interaction (1938). To explain the principle of continuity, Dewey stated, “Every experience lives on in further experiences” (1938, p. 27). It is the experiences in life that help to shape our world view, and as such, those moments of learning through experience have a great and long lasting impact. The principle of interaction would require the teacher to examine the learning experience through both its objective and internal conditions (Dewey, 1938). This requires the teacher to examine the experience itself, as well as the learner’s previous experience and ability. Therefore, the student’s previous knowledge and ability must be included as a relevant factor in the learning and assessment process. Kolb (1984) spoke to this and acknowledged the importance and value of addressing previous experience: “If the education process begins by bringing out the learner’s beliefs and theories, examining and testing them, and then integrating the new, more refined ideas in to the person’s belief systems, the learning process will be facilitated” (p. 28).
Experiential Learning Theory

David Kolb defines learning as “the process whereby knowledge is created through the transformation of experience” (1981, p. 38). As explained by Proudman, it is the process of the learning and teaching that has taken place during an experience that determines whether or not an experience had the ability to provide a learning opportunity (1992). The experiential learning theory was developed by David Kolb and stems from the work done by Dewey, Lewin and Piaget (Kolb, 1984). It purports that in the process of learning one must be able to both experience and reflect.

To further defining this process, Kolb developed a model (Figure 1., below), which places emphasis on the experience of the learner, their reflection upon that experience as well as the transfer of newly acquired information (Gass, 1985).

This model identifies the four different kinds of abilities present in all learners: concrete experience, reflective observation, abstract conceptualization and active experimentation. (1984). Kolb stressed that in order for learning to occur the student must exercise all four of these abilities (1984). Kolb (1984) discussed the particular problems associated with having to experience and reflect at the same time, but stressed that the individual must choose which aspects of learning to employ at any given time.

The model designed by Kolb stresses the importance of action-reflection through the process of moving through four modes of learning (1984) and his model is an effective method for identifying both learning development and assessment. It is reminiscent of what Dewey referred to as the “primary and secondary experiences” (1958). It is in the primary experience where the individual encounters the “immediate, tangible, and moving world that presents itself to the senses” (Hunt, 1981, p. 206) and in the secondary where the individual “takes these experiences and makes them “precise, microscopic and refined” (Hunt, p. 206).

To understand the workings of this model in greater detail and how it relates to this study, it must be understood that the model reflects two distinctly different dimensions, that of experimentation and reflection (1984). The learning process lies in the transactions amongst the four modes which lie on either side of these dimensions, and through movement between them during the process of grasping experience and transforming it (1984, p. 41). Kolb uses a simple example of a person becoming aware of their surroundings to describe the mode of concrete
experience (CE), (1984). It is in this sense that a person is experiencing their surroundings, what he refers to as a mode of knowing called apprehension (p. 43). However, this is not enough for knowledge, and it is what one does with this information (the mode of knowing Kolb calls comprehension (p. 43)) that will allow one the ability to “create for [one’s self] and communicate to others a model of that situation that could last forever” (Kolb, 1984, p. 43). It is how one thinks about and conveys the experience to themselves that will allow for learning to occur. This comprehension (found opposite CE in the learning model) refers to the mode of abstract conceptualization (AC). In order for one to move from CE to AC the learner must be enabled with the ability to reflect upon the initial immediate experience and observe the experience from many different perspectives (p. 30). Kolb refers to this mode within the learning model as reflective observation (RO). Once an individual has had the opportunity to experience, reflect, and then abstractly conceptualize, they must then be able to use what they’ve learned through the process thus far to make decisions and solve problems (p. 30), which, in the learning model, is referred to as the mode of active experimentation (AE).

**Use of the Experiential Learning Model**

As a means to make the Kolb model more accessible to the classroom experience, researchers (Harb et al., 1993) broke down the learning model into quadrants and developed a list of specific classroom activities that could be correlated directly to the four different quadrants. Found within basic classroom lessons, these “learning activities”, including examples such as field trips, group problem solving, homework problems, formal lecture, etc. (Harb et al., 1993, p. 72), can be considered representatives of particular aspects of the Kolb learning cycle (1984). This work, in effect, makes it easier for educators to identify aspects of the Kolb model that are present in everyday teaching and classroom activities.
Harb, et al. (1993), sought to provide the most effective teaching methodology for college engineering students by providing teaching styles and examples that best exemplified the quadrants of the Kolb model (1993). In order to achieve this goal, the developers of this study established concrete examples to show how the Kolb experiential learning model could be identified within basic classroom activities and lessons (1993). Using a model developed by Stice (1987) and McCarthy (1987) (see figure 2.), which simplified the four aspects of the Kolb model into workable quadrants, Harb et al. were then able to further identify classroom examples to represent each of the four aspects of the Kolb model (see figure 2.)

The learning activities defined within the paper, while originally meant for college level activities, are translatable to any grade or age level as the activities and lessons defined are not grade or age-specific (please see Table 1.)


The quadrants defined in Table 1 provide examples that demonstrate “teaching through the cycle” (Harb et al., 1993), the process of teaching through incorporation of the four components of the Kolb experiential learning model.
For learning to occur, an experience should provide the opportunities for the student to engage with the various aspects of the Kolb learning model, with particular regard for student engagement, action and reflection (Kolb, 1984), and students must make the connections themselves in order for effective learning to take place (Roberts, 2002). It is also important to be able to relate the information gained in a way that has relevance for the student. Therefore, this study performed an interpretative phenomenological analysis of the experience had by five middle and high school teachers that participated in an experiential education professional development course. Through this analysis, the researcher incorporated the concepts of the Kolb Learning Model as well as the methodologies described by Harb et al. in order to identify ways in which teachers had benefitted, and how they perceived that their students benefitted, through their participation in this EEPD.

**Conclusion**

In summary, experiential education theory as described supports the notion that learning is a process through which there must active participation, meaning and relevance for the learner. As Dewey’s work defined the aspects of learning through an experiential lens, David Kolb expanded the work of Dewey and others to develop a model to further explore the experiential learning process and to define experiential learning theory. As it was the intention of this study to understand the experience had by teachers as participants in an EEPD course, the experiential education and learning theories guided this process and analysis.

**Chapter Two: Literature Review**

**Introduction**

A Nation at Risk (1983) warned that the nation’s schools were underperforming and spoke to the need for reform in order to be successful in the upcoming “information age” (Bell, p.
4). More than two decades later, today’s schools have continued to see some of the same struggles addressed in A Nation at Risk, as recent studies (National Assessment Governing Board, 2010) have indicated that American schools do not adequately educate students effectively in science. While A Nation at Risk made recommendations for teachers and promoted the ideas of salary examination and teacher subject area competence, they did not address the methods teachers might use to teach the material competently (Borek, 2008), areas that might need the most improvement.

This literature review examines national and international trends and issues in science education, analyzes the literature on improving science education and explores the current and past thinking on how experiential education practices may help to alleviate some of these current concerns and provide teachers with the methodologies needed in order to effectively teach in their content areas. It concludes by discussing the role that experiential education can play in today’s classrooms. While many studies have been done which examine experiential education programs (Baldwin et al., 2004, Hattie et al., 1997, Raschick et al., 1998, Sheard & Golby, 2006), this research contributes to the overall knowledge base for the understanding of the teacher experience through their participation in an experiential education professional development course geared toward improving the science classroom experience for students.

**Science Education Struggles**

Science education plays a significant part in the lives of members of society, and in order to be able to participate in policy decisions citizens must comprehend the nature of scientific knowledge and practices (Tomasek, 2006). As Hurd asserted, it is the role of science education to work to develop scientifically literate citizens in order to meet the societal demands of change (as cited in Hinojosa, S., 1996, p. 13). Unfortunately it seems that as a country we may be
bringing our students further away from this goal (National Science Board, 2012).

The Relevance of Science Education (ROSE), a comparative study of students’ views of science and science education, has found that through the gathering of research, opinion polls, surveys and educational statistics that science education is getting further from producing scientifically literate citizens as students have a lack of interest, and meager understanding of the contents and methods of science and technology (2004, p. 10). According to the Nation’s Report Card (2009), “fewer than one-half of 4th, 8th and 12th grade students perform at or above the Proficient level in science at all three grades, and only 1 percent of 4th-grade students, 2 percent of 8th-grade students, and 1 percent of 12th-grade students performed at the Advanced level” (NCES, 2012). A graph below from the National Center for Education Statistics indicates the US and OECD average in Science and math for the years 2003, 2006, and 2009, and it is clear to see from this graph that while the US has remained steady with the OECD science performance for 2009, both have declined since 2006 in areas where students score below proficiency level 2. Results from the 2012 Program for International Student Assessment (PISA) show that American students are not showing improvement, ranking only average in reading and science, and below average in math (OECD, 2014).
While there is a need to address the issues in science learning in order to continue to encourage life long interest and promote careers in science, there is evidence to suggest that science interest among students has declined (Schmidt, 1997; Schreiner, C. & Sjoberg, S., 2004; Sladek, P., et al., 2010, Swarat et al., 2012). While science and technology student numbers have been increasing in absolute terms, they are decreasing relatively (Hemmo, 2008, p. 114), indicating there is a lack of interest as students progress through the grades. This lack of interest in science and technology may see greater repercussions than we realize. As quoted from the US National Science Board:

If trends identified in Indicators 2004 continue undeterred, three things will happen. The number of jobs in the US economy that require science and engineering will grow; the number of US citizens prepared for those jobs will, at best, be level; and the availability of people from other countries who have science and engineering training will decline, either because of limits to entry imposed by US national security restrictions or because of intense global competition for people with these skills. The United States has always
depended on the inventiveness of its people in order to compete in the world market place.

Now, Preparation of the S & E workforce is a vital arena for national competitiveness. (as cited in Hemmo, 2008, p. 3)

This decline in interest is cause for concern that the American student could be falling behind their international counterparts (OECD, 2010). While the US has historically had one of the most highly educated work forces in the world, according to the OECD (2010) the advantage is declining (p. 15). According to The National Science Board, data from the 2009 PISA showed that the US fell below 12 of the 33 members of the OECD in science literacy rankings among 15 year olds (National Science Board, 2012). In 2012 that margin increased and in science the US dropped below 22 other education systems (OECD, 2014).

Students from around the world were surveyed in the Relevance of Science Education Study and indicated increasingly negative responses to science across Years 7–10, both nationally and internationally (Schreiner & Sjoberg, 2004). A study done over the course of two decades in Australia indicates a general decline in students’ interest and enjoyment of science as they transition from primary to secondary education (Tytler, 2007). The areas for science decline seem to be far-reaching.

Identifying the Issues

There is a lack of enthusiasm for science among elementary and middle school students (Fensham, 2006, Swarat et al., 2012). Fensham (2006) pointed out that three different studies done in three different countries all tie in the same lack of enthusiasm for science among students, and indicate strikingly similar explanations (p. 70). Student perception of science from this study included a general lack of interest for the reasons that: 1. The content was irrelevant to students’ lives; 2. Student opinions were not involved in the transmission of knowledge; and 3. That
science was more difficult to learn than other subjects (Fensham, 2006). It is important to note that the first two mentioned directly correlate to experiential education theory, which state that education must incorporate meaning and relevance for the student (Dewey, 1938), and also require the student to be an active participant in their learning (Dewey, 1938, Kolb, 1984). Swarat et al. identify the same lack of interest among science students and indicate a relationship between student interest and lack of hands-on activities in the classroom (2012).

Examining textbooks and curriculum, *A Splintered Vision* (Schmidt, 1997) argues that perhaps a part of the problem stems from the American education system relying too heavily on wide coverage of topics, with little depth. By examining textbooks in the US, they found that of the five core subjects covered in science, “Internationally, the top five topics account for about 75 percent of textbook space on average. This is true in Germany as well, and in Japan the top five topics account for over 80 percent of the space. By contrast, the five most emphasized topics account for less than 50 percent of the books’ space in U.S.” (Schmidt, 1997, p. 59). This may be indicative of vast coverage of information with little depth as a trend found internationally.

Chinn and Malhotra (2002) have addressed similar concerns with regard to inquiry-based learning, and have found that many students do not receive what they have deemed “authentic inquiry”, a term used to describe a deeper level of inquiry-based learning. They examined inquiry-based tasks included in science textbooks, and found that the textbooks failed to provide authentic reasoning (Chinn & Malhotra, 2002). In general, many of the tasks given to students in science exhibit inquiry-based activities but don’t engage students in scientific reasoning, a key component to critical thinking and learning (2002).

“Many teachers in public schools have little knowledge of what inquiry is and have been reluctant to implement standards-based instruction in their practice” (Johnson, 2007, p. 49). In
support of this notion, Wong and Hodson (2009) reported that the science learning that is happening in the classroom bears little resemblance to what is taking place in the real world. By interviewing thirteen scientists from around the world, they found that “. . .their practices provide a somewhat striking contrast to the image of science usually portrayed in science curricula and textbooks” (Wong & Hodson, 2009, p. 38). Lessons in classrooms lacking hands-on activities leave students disinterested in science (Swarat et al., 2012). Science experiments in class often lead students to follow the “cookbook” methodology, and it has been found that when students do not get the results that they expect, they question themselves, rather than the results, which is antithetical to science development (Chinn, 2002). Laboratory experiments constantly seek new answers, and results are simply a byproduct of the process. An unexpected result could lead to breakthroughs in medicine and technology. As a result of providing mostly simple inquiry tasks in the classroom, students may develop an overly simplistic view of science, which does not effectively translate into real world application and may leave students disinterested (Chinn, 2002, Swarat et al., 2012).

Science learning concerns extend beyond the United States, and in similar fashion, The Australian Council for Educational Research have made claims that while authentic inquiry-based learning is valuable and important, Australia is not necessarily providing this for its students (Tytler, 2007). They have pointed out that science learning needs to have an authentic basis, and that the science students engage with should demonstrate the nature of science as it works in the world, in a way that allows students to develop an understanding of science in practical action (Tytler, 2007, p. 40).

Science education has been disjointed and its curriculum overloaded (Duggan, 2002) as educators struggle to cover material on required topics. This issue is not a new problem, and has
been around for at least as long as Dewey’s era (Hanegan, 2009).

As well, teachers often rely on assessment methods that are easily attainable, but not always desirable, such as test scores, which rarely present an entirely true picture (National Research Council, 2011). If teachers were better prepared, perhaps this could lead to increased inquiry-based learning in the classroom. Experiential education activities may provide an effective alternative for teachers in terms of producing measurable outcomes (Ewert & Sibthorp, 2009, p. 377).

**Incorporating an Inquiry-Based Approach**

Experiential education programs address these and other concerns to seek an effective learning environment for students. In doing so, some programs have encouraged an inquiry-based approach (National Research Council, 2011, p. 47).

Chinn and Malhotra (2002) stress the importance of an authentic science learning experience for students in order for them to understand how scientists perform research in real-life settings (Chinn & Malhotra, 2002). Inquiry-based learning can mimic for the student the experience of the researcher or scientist, and many feel that this is one of the most important aspects to science learning (Duggan, 2002, Fensham, 2006, Hume, 2009, National Research Council, 2005, Swarat et al., 2012). As explained by Hume (2009), science education is being called upon as we seek to find greater science literacy in our students. Inquiry-based learning has the potential to be highly effective in increasing a student's reasoning and problem-solving skills, and has also been shown to increase reading and writing abilities (Alberts, 2008).

A publication of the National Research Council highlighted the manner in which students best learn, and has developed new guidelines which help to offset the simple learning in order to provide students with an opportunity to “use new understandings to engage in new inquiry”
(2005, p. 398). Principles they cited in promotion of this include addressing preconceptions, a notion that students may perceive the world in a particular way, and the observations they make can be extrapolated to larger world issues in incorrect ways (p. 399). Reminiscent of Dewey, this concept depends upon many of the ideas developed originally in “Experience and Education” (Dewey, 1938). An example given is that students may incorrectly assume that the reason for seasonal change is because the planet moves closer and further away from the sun (NRC, 2005). They may believe this because personal experience can show that one gets colder and warmer as they move closer and further away from a heat source. Students may go their whole lives misunderstanding how things around them are happening, and it is the responsibility of the science teacher to use these real world examples to help students become aware of and overcome these misconceptions, as well as encourage them to readdress the way in which they make assumptions (Atkins, 2003).

The second principle has addressed the process of inquiry and stresses the understanding that students often do not question what is happening in their science courses (NRC, 2005). Students quite often assume that what they are learning in science is fact, and therefore question little (Chinn & Malhotra, 2002).

Another principle addressed by the NRC is metacognition, or the promotion of the student’s own acknowledgement of what knowledge they’ve gained, and what areas they are lacking (NRC, 2005). Metacognition relates directly to the reflective observation abilities (RO) component of the Kolb experiential learning model (1984), as it requires the student to reflect on the information they’ve obtained and evaluate its connection internally. An experience that supports learning will provide prompts that guide individuals to reflect on their own thinking (Fenichel et al., 2010).
Students learn more deeply when given a learning opportunity which addresses real
world problems (Barron, B. et al., 2008), and classroom teaching that promotes experiential
education has been shown to promote higher order thinking skills in students (Ives & Obenchain,
2006). The National Research Council has acknowledged the importance of inquiry-based
learning and the need to make it a priority and focus in classrooms, rather than something that
teachers set aside time for in addition to regular programming (2005, p. 405). In order to provide
students with a valuable, long lasting and successful learning experience, teachers must address
(STEM) teachers should have a deep knowledge of their subject matter and ‘an understanding of
how students’ learning develops in that field, the kinds of misconceptions students may develop,
and strategies for addressing students’ evolving needs’” (NRC, 2011, p. 47).

Similar to Freire’s (1970) approach to student-constructed knowledge, aspects of
experiential education theory can be seen in the constructivist theory (DeLay, 1996).
Constructivist theory allows for the student to create meaning out of the experience in which
they participate (DeLay, 1996). In this sense, the student learns through his or her own
engagement with the world, and thus develops meaning from such interactions (Quay, 2003). It
is important to acknowledge that constructivist learning is dependent upon the student (DeLay,
1996), and that the impetus therefore is on the student to engage and develop meaning. Qualters
(2010) has pointed out that this requires reflection on the part of the student in order to integrate
and transform their experience. The professional development course in which the teachers in
this study chose to participate encouraged teacher engagement in order for the teacher to find
meaning and connect with the experience within which they were participating.

The Role of Experiential Education
“It is time for experiential educators to ‘come inside’ and enter the public school system as a means to engage in a more meaningful and integrated experiential education practice” (Breunig, 2008, p. 89). Active learning experiences can encourage a student to go beyond the developing skills and help them to build the goals and skills that are socially responsible, particularly in performance courses and projects (Kindelan, 2010). Students who engage in experiential education have been shown to perform better than their counterparts (Ives & Obenchain, 2006). While experiential education does not have to take place outside of a standard classroom in order to be effective, the learning environment has great importance, which many researchers and educators have recognized (DeLay, 1996, Alberts, 2008). Teachers that are aware of this and work toward providing students with an experiential learning environment may be doing a great service for their students as a result. While many teachers may not be prepared to meet the challenges presented in providing an experiential education in the classroom, (NRC, 2011), many professional development courses and programs are designed with the intention of helping teachers to address these concerns.

**Professional Development**

Professional development refers to the “... specialized training, formal education, or advanced professional learning intended to help administrators, teachers, and other educators improve their professional knowledge, competence, skill, and effectiveness” (Hidden curriculum, 2014). For teachers, common areas of focus in professional development include, but are not limited to, training in certain subject areas, learning new techniques and skills including technology, technical, quantitative, classroom management, leadership, action research or analytical skills (Hidden curriculum, 2014). Teachers may also take professional development courses in order to earn formal certifications or to obtain a higher degree (Hidden curriculum,
In the field of science, professional development is particularly important in order to keep teachers informed of new studies and research taking place regularly, as well as to inform teachers of how to teach science curriculum (NRC, 2012).

Professional development has been considered the primary mechanism that schools can use to improve teacher performance (Hidden curriculum, 2014), and is thought to be a key instrument for teacher improvement by policy makers (Borko, 2004, NRC, 2012). Specific to the science classroom, inquiry-based professional development has been touted in educational reforms as an important means for teachers to adopt and implement inquiry-based methodology into the classroom (Kazempour, 2014).

While professional development is considered fundamental to the improvement of the teacher and classroom experience for students (Borko, 2004, Opfer & Peddler, 2011, Van den Bergh, 2014), research has shown that learning activities provided through professional development for teachers are characterized as ineffective (Hanushek, 2005, Opfer & Pedder, 2011, Sykes, 1996). Teachers often participate in one-day workshops, institutes, courses, and seminars (Johnson, 2007) but these programs often do not do enough to address the needs of teachers who are looking for new teaching strategies or methods (p. 49). It seems that teachers have been prompted to have knowledge in their content area, but have not necessarily been given the right tools to be able to teach in a manner deemed most effective for science learning (Gulamhussein, 2013, NRC, 2005, Van den Bergh, 2014). Professional development programs and courses are designed with the intention to provide teachers with the tools they need to improve the classroom learning experience for their students, but the inadequacy of the general professional development offered for teachers has been referred to as “the most serious unsolved problem for policy and practice in American education today” (Sykes, 1996, p. 465).
Effective professional development

“... High quality professional development programs can help teachers deepen their knowledge and transform their teaching” (Borko, 2004, p. 5). Recommendations for effective teacher professional development suggest the following areas of interest be addressed with regard to core areas of teaching: Content, curriculum, assessment and instruction (Gaible & Burns, 2005). Professional development that explicitly focuses on subject matter can help teachers develop the understandings necessary for content mastery (Borko, 2004). By providing teachers with experiences that engage teachers as learners, through activities such as solving mathematical problems and conducting scientific experiments, professional development can be made to be particularly effective (Borko, 2004, p. 5). It is important that, especially in the field of science, teachers are provided with the opportunities to participate in PD programs and courses which will have relevance in their classroom and teaching experience in order to be able to affect positive change in the classroom (OECD, 2009, Van den Bergh, 2014, Opfer & Peddler, 2011).

The professional development course in which the teachers of this study have participated is an experiential education professional development course designed with many of the concerns discussed in this section in mind. This study has examined the ways in which teachers were affected after participating in a professional development course that actively sought to overcome the obstacles often found in teacher professional development courses.

Chapter Three: Research Design

Introduction

In order for students to succeed and become both scientifically literate and competent members of society, they must be given opportunities to learn in a manner that supports the promotion of scientific literacy (Tomasek, 2006). While there are many professional
development courses designed to aid the teacher in this task, unfortunately, most provide little value to the teacher, and in fact, create no change in the classroom experience for students (Gulamhussein, 2013, Johnson, 2007, OECD, 2009). While research points to ways in which the professional development courses themselves may be improved as a means to improve the classroom experience for participants’ students (Gulamhussein, 2013), if one is to truly understand how a professional development course impacts teachers, it is necessary to understand the teacher perspective as a participant in a professional development course. The researcher identified a group of teachers who voluntarily participated in an EEPD course in which the goal was to instruct the teacher-participants on how to develop meaningful watershed educational experiences with and for their own middle and high school students (Osche, 2011). By performing an interpretative phenomenological analysis of the teacher experience, this study provides insight on the outcomes that resulted in changes to teaching practice as a result of their participation in the EEPD course. The primary research question for this study is:

- In what ways have teachers’ participation in an experiential education professional development course changed their classroom teaching practice?

**Purpose Statement**

This research study centers on a group of teachers that have chosen to participate in an experiential education professional development course. Professional development programs aim to improve the classroom experience for students through their work with teachers, and while studies aim to assess the outcome of students as a result of their teacher’s participation in experiential education programs, it is important to note that outcomes can be difficult to measure and often have many confounding variables (Qualters, 2010, p. 56). This study focused on the experience of the teacher rather than the student as a means to clarify and understand the changes
in the classroom that occurred as a direct result of teachers’ participation in their EEPD course. Because the course in which these teachers chose to participate sought to provide teachers with the knowledge to educate their own students in a way that would provide them with a meaningful experiential education experience, this study analyzed the teachers’ experiences and examined the impact the course made on them as a means to understand how their participation changed their teaching practice. Through the deeper understanding of the teacher perspective it became better understood how students were able to have an experiential education learning opportunity in the classroom.

The researcher interviewed seven teachers that participated in an experiential education professional development course, and performed an IPA on the interviews of five. The interviews were analyzed using the methodology described by Smith, Flowers and Larkin (2009). Teacher interviews focused on whether or not the teachers benefitted, and whether they perceive their students had benefitted by gaining a greater understanding of how they implemented the watershed course curriculum into their own classrooms, and how the students responded.

**Methodology**

This study sought to understand the changes that occurred in teachers’ practice in the classroom after their participation in this EEPD course, and therefore an interpretative phenomenological analysis (IPA) was well suited to examine and identify the experience of the teacher. “IPA is a qualitative approach committed to the examination of how people make sense of their major life experiences” (Smith et al., 2009, p. 1). IPA research aims to focus on people’s experiences, understandings, or in some cases, perceptions and views of the participants (Smith et al., 2009). Because the perception and views that teachers had from their participation in this EEPD course might have directly affected their likeliness to implement proposed methods for
experiential education in their classroom, it was imperative to try to understand their experience throughout participation and after completion in order to understand how PD courses such as this may make an impact the participant.

The Teacher-Participant in an Experiential Education Professional Development Course

Teachers in this study participated in an experiential education professional development course designed to help teachers learn how to provide their students with an environmental education experience that goes beyond the one-day field trip. Field trips are often seen as little more than a break in the monotony to students, and thus, have little long-lasting educational impact (Roberts, 2005). In this particular program, teachers learned to take students into the field for more regular and intense science lessons, and thus promoted a change to the standard field trip model typically found in traditional classrooms. This interpretative phenomenological analysis sought to identify how their participation in this EEPD benefitted their teaching practice, as well as how they perceived their students benefitted.

Foundations of IPA

Interpretative phenomenological analysis is a type of research that is qualitative, experiential and psychological (Smith et al., 2009), the roots of which stem from the philosophical areas of phenomenology, hermeneutics and idiography.

Phenomenology. Phenomenology, developed by Husserl, was established as a philosophical approach to comprehend the lived experience (Smith et al., 2009), and is the means by which a person makes sense and develops meaning from events in their life. Similar to Kolb, Husserl asserts that there is a necessary reflection upon an experience that takes place in order for us to make sense of an experience (Smith et al., 2009). Phenomenology aims to identify the way in which an individual perceives an event as a means to make sense and give meaning to it
To do this, a researcher must “bracket”, or put aside his or her personal perceptions of experience to get as close to the phenomenon of the individual as possible (Broomhead, 2013). This research examined the “lived experience” of teachers that participated in an experiential education professional development course. As the researcher has a background in experiential education it was extremely important to “bracket”, and put aside preconceived ideas regarding the teachers’ participation in the EEPD course.

**Hermeneutics.** Hermeneutics provides a means to examine how a phenomenon appears to the individual (Smith et al., 2009) and requires the ability to “make meaning comprehensible” (Pietkiewicz, 2012) through the sharing of a lived experience. The analytic process may be considered *double hermeneutic* as IPA requires the individual to examine and interpret their lived experience, while the researcher works to interpret what they’ve shared and perform their own interpretation (Pietkiewicz, 2012). This research study relied on a double hermeneutic approach, as the researcher analyzed the experience of the participant through the sharing of their experience during the interview process, which was recorded and transcribed. Through a thorough read and rereading of the interview text, the researcher performed a hermeneutic circle, effectively developing a deeper and greater meaning of the text by examining the smaller parts as related to the whole and vice versa as the context and meaning became clearer each time (Smith et al., 2009).

**Idiography.** Contrasting the nomothetic principle in which generalizations are made about groups and populations through data provided by large sample sizes (Pietkiewicz, 2012), idiography focuses on the particular and specific in order to develop generalizations about the whole (Pietkiewicz, 2012, Smith et al., 2009). For this study idiography was employed as it thoroughly examined the experience of each individual as a means to develop a detailed
understanding of that experience. Through this thorough and detailed account and study of the particular, greater and overlapping meaning amongst the larger whole of the group of participants was identified as a result.

**Justification for IPA**

An interpretative phenomenological analysis was selected for this study because it aims to explore teachers’ direct experience in a professional development course by focusing on the people’s experience of that phenomena (Smith et al., 2009). Gulamhussein states that the majority of professional development in which teachers participate will not translate into an improved classroom experience for students (2013). Therefore, it is important to understand what teachers take from their experience as participants in order to develop an understanding of how such a course provides benefit to teachers and their students. Because IPA relies on an idiographic in-depth analysis of individual cases (Pietkiewicz, 2012), this study provided insight into the perspectives of the individuals who participated by helping to define whether or not their experience provided benefit for themselves and for their students. IPA also helped to define and understand the commonalities amongst individuals (Smith et al., 2009) and by developing a knowledge base which identified similarities amongst participants, the researcher began to garner an understanding for the value in which participation in such an EEPD might offer for others.

**Site and Participants**

This study interviewed seven and analyzed five public middle and high school teachers from different schools in the New England area that voluntarily chose to participate in an experiential education professional development course run through the education department of an aquarium in New England. Two interviews were disqualified from the study due to a lack of adherence to the teacher parameters, and for recording issues, which left one interview
unintelligible. The researcher identified and selected participants for this study with permission from the institution. Candidates were contacted and solicited by the researcher. The course in which they participated was a 3-day intensive summer program with callback sessions requiring the teacher participant to return later in the school year with a report on the work they did with students as a result of their participation. Teachers who participated in this course came as individuals and not as school representatives and had the option to take the course and gain graduate credit for an additional fee. This particular group of teachers was selected because they completed the course and had over a year to be able to demonstrate impacts of the program in their classroom teaching. “The idea behind qualitative research is to purposefully select participants or sites (or documents or visual material) that will best help the researcher understand the problem and the research question” (Creswell, 2009, p. 178). Through the identification and examination of the experience of the teacher, this study identified what changes occurred that caused change in teachers’ practice, and therefore impacted the student experience in the classroom.

**Professional development overview.** The program in which the teachers in this study participated is a teacher professional development course put on by the education department of a large aquarium in New England. This 3-day course ran once per summer between 2011-2013, and incorporated primarily public school teachers from the New England area. Instructors of the course included educators from the aquarium’s education department as well as outside teacher affiliates and members of the aquarium community with expertise in particular subject areas relevant to the course. The course enrolled between 10-20 middle and high school science teachers, and offered instruction through classroom teaching and field experiences. Teachers that participated in the course were required to return to the aquarium later in the school year for two
call back sessions in which they demonstrated how they integrated the course into their classroom teaching. Teachers had the opportunity to receive graduate credit for their participation and completion of the course. Course materials centered on the various methods middle or high school teachers might use to educate their own students about the watershed in their particular area (Aquarium, 2013). This was an optional course for teachers looking to increase their professional development and was not a required program for teachers.

Research Procedure

Candidates for this study were identified from a list of participants given with permission from the institution. The researcher obtained the contact information to solicit participants for this study. As the program is no longer running, the researcher used email correspondence to reach out to subjects that participated in previous years, and gave an explanation of the purpose and nature of the study (Broomhead, 2013).

Subjects should be “purposefully selected” (Creswell, 2009), and this study sought to obtain individuals from the same course that participated at the same time. The researcher also sought to obtain relative uniformity amongst participants in what Smith et al. refer to as “obvious socio-demographic factors” (2009). However, as it is important to remain pragmatic (Smith et al., 2009) the researcher “expanded [the] inclusion criteria” (Smith et al., 2009, p. 50), and obtained subjects that participated in three different years. As well, teachers in this study taught at schools in towns that differed significantly from one another socio-demographically. These differences had little impact on the results of the study. IPA studies rely on small sample sizes (Smith et al., 2009), and therefore this study sought to retain 6-8 participants to interview in this study. The researcher interviewed seven participants, but due to a technical issue that prevented one of the interviews from being recorded, and a lack of relevance of the seventh interviewee (interviewee
taught elementary level grades 1-3, which did not meet the criteria for this study), this study retained and analyzed five transcriptions, which was a significant number of participants for this study.

After selecting participants, the researcher arranged an agreed upon time to interview the participant by phone. The participant was encouraged to “tell their own stories, in their own words” (Smith et al., 2009, p. 57) and therefore length of interviews varied by individual, and lasted between 35 and 65 minutes. The interviews were recorded and transcribed for analysis (Smith et al., 2009). An interview schedule was used, and questions were set out in the order in which the researcher preferred to ask them (Smith et al., 2009). The researcher began with a “warm-up discussion” as a means to reduce any potential tension the participant might have had (Pietkiewicz, 2012). Ten semi-structured questions were prepared, and the verbal input from the researcher was minimal (Smith et al., 2009). Semi-structured interviews allow for the researcher and participant the ability to have a dialogue in real time and this in turn allows for the researcher the flexibility to work with and address unexpected issues as they arise (Pietkiewicz, 2012). Questions were generally open-ended and few in number as a means to elicit views and opinions from the participants (Creswell, 2009).

Following a protocol developed by Smith et al. (2009), the transcribed interviews followed a set of processes, “moving from the particular to the shared, and from the descriptive to the interpretative” (Smith et al., 2009, p. 79). The researcher “immersed herself in the data” (Smith et al., 2009, p. 82), by reading and listening to the transcribed and recorded interviews multiple times. Smith et al. recommend the possibility for recording one’s own thoughts and setting them aside as a means of “bracketing” (2009), and the researcher enlisted this action as it was found to be a helpful way to more fully immerse in the text itself. Following the reading and
rereading of the text, the researcher began to take notes and was able to “begin to identify specific ways by which the participant [talked about, understood and thought] about an issue” (Smith et al., 2009). A section along the left side of the transcription was used for the recording of exploratory comments (Smith et al., 2009). Noting the types of comments suggested by Smith et al., those included comments that referred to the content of what the participant had stated (descriptive), and the meaning of what the participant has said (conceptual) (Smith et al., 2009). The language use of the participant (linguistic) was not analyzed, as it did not seem appropriate nor relevant for this study. By analyzing the content in this way, the researcher more readily engaged with the text and was able to analyze on a deeper interpretative level (Smith et al., 2009). This process repeated for each interview.

Upon completion of the note-taking process for all interviews, the researcher analyzed the exploratory comments and identified emergent themes (Smith et al., 2009). The researcher recalled during this process the hermeneutic circle (Smith et al., 2009), and continued to see the whole in relation to its parts, and vice versa. The researcher continued to follow the steps identified for each case, and upon the completion of all cases, the researcher began the process of identifying patterns that emerged across the cases (Smith et al., 2009). The researcher used a method described by Smith et al. in order to do this, and laid out the themes of each case in a large space in order to visually identify connections (2009). One means of looking at the data was to cross-reference the themes with the Kolb experiential learning model (1984). This model served to provide background for the review. Upon completion, transcriptions of each interview were sent to each participant.

Validity and Credibility
Teachers in this study self-selected to participate in a summer professional development course, and therefore, potential for bias existed as they may have been inclined toward a particular outcome more so than a teacher that was required to attend the course. However, as this study sought to understand the experience of the participant and was not, in effect, trying to make broader generalizations about teacher participants in professional development courses, bias remained limited in scope. Because the researcher is a previous employee of the aquarium that provided the course in which the participants attended, the potential for researcher bias existed. The researcher in this study had been an employee of the aquarium’s education department in various capacities, including instructing and coordinating programs, for approximately ten years. However, the researcher had not worked for the aquarium since 2010 and was not involved in the development or implementation of this professional development course.

IPA studies purposefully select a small sample size with which they choose for their analysis (Smith et al., 2009). As well, IPA studies do not form a hypothesis nor do they conduct statistical analysis (Perkowski, 2013). These aspects of IPA may serve as limitations for the research. However, by performing thorough analysis, which provided ample data, the need for large sample sizes from which to draw data was negated. This research focused deeply on the experience of a select few, and therefore may not represent the entirety of those that have participated in the professional development course. However, as this was not the intent of the study, this limitation is justifiable for the purposes of this research.

**Protection of Human Subjects**

The well being of participants is of utmost importance, and the study presented no risk to those who participated in the interview process. Each participant was given a consent form and
was made clear that participant identity would be kept confidential. As this research did not directly impact the participant’s employment, it was not a direct concern that participants would fear any retaliation from their place of employment. Had the participants had concerns at any point they had the opportunity to ask questions or remove themselves from the study at any time. All participants completed the study. All names of participants have been changed to maintain anonymity. All data was collected digitally and transferred to a password-protected computer after each interview. Data was deleted from the original recording device. Only the researcher has access to the password-protected computer. Interviews were not discussed. Signed consent forms are digitally stored in an online account which is password protected, and will remain there for three years following the study.

The research process followed all guidelines as written by Northeastern University’s Office of Human Subject Research. An application to conduct research with proposed participants was submitted to the Institutional Review Board. As defined by Northeastern University for the purposes of human subject research protection, this study adhered to the ethical principles of research and was subjected to an independent review of protocols involving the human subjects identified for this study (Northeastern University, 2013).

Conclusion

The purpose of this study was to perform an interpretative phenomenological analysis of teachers’ experiences as participants in an experiential education professional development course. It intended to identify how the individual’s participation impacted their classroom teaching practice. IPA provides an in-depth examination of how individuals make sense of their life’s experiences (Smith et al., 2009), and through the examination of the experiences of a group of middle and high school science teachers, this study gained a more through understanding of
the experience of the individual, how their participation impacted their classroom teaching, and how changes in the classroom occurred as a result. In understanding the changes the experiential education professional development course caused in teachers’ classroom teaching practice, this research can shed light on the ways in which experiential education professional development courses impact students of teachers who’ve participated as well as the teachers themselves.

Chapter 4: Findings and Analysis

Experiential learning methodology has come to be valued as an effective way for students to learn science (Brown, 2006). Through this in-depth analysis, the researcher developed an understanding of the meaning of this experience for the participants and further comprehended how teachers made sense of their experience in this experiential education PD course. The results of the research begin to help one to understand how experiential education professional development courses like this have the potential to be used to encourage a renewed and strengthened interest in the sciences through changes in teaching practice.

The purpose of this study was to investigate the experience of teachers who participated in an experiential education professional development course, particularly with reference to how they benefitted, and how they perceive their students benefitted. An overview of the professional development course may be found on page 40.

To investigate this question the interviewer conducted seven interviews, of which five were analyzed (please see page 39 for a description of selection process). Teacher profiles have been provided at the beginning of this chapter to offer background information for each teacher, as well as to enlighten the reader on the teacher’s school setting. Through the analysis of these five interviews, three superordinate themes emerged, with seven corresponding nested themes. The superordinate themes and corresponding nested themes were: 1) changes to teacher practice
(1.1 classroom teaching changes, 1.2 course content changes); 2) student connection building (2.1 engagement, 2.2 meaning and relevance, 2.3 place-based learning); 3) long term impacts (3.1 impacts on the teacher, 3.2 impacts on the student). Superordinate and nested themes were identified as those that occurred in at least four of the five participants’ interview data.

**Participant Profiles**

The teachers included in this study taught in public schools, and four of the five were middle school science teachers. The fifth teacher was a high school science teacher of elective subjects. In this study, Michelle worked in the same school as Liza and referred her to the watershed course. Jenn worked in the same school as Sally, and referred her to the watershed course.

Liza taught seventh grade life science and had been in her current role for only one year at the time of the interview. Although she was in her seventh year teaching, she still felt as though she was a new teacher and struggled to make changes. “. . . I still see myself as a new teacher and I’m not yet confident in adding more things to my curriculum.” She felt limited because of time constraints put upon her due to curriculum requirements and standardized test preparations, and therefore implemented a one-day lesson that she designed during the watershed course. She did not take students into the field. This lesson was not based on the watershed course, but was done as the final assignment for the watershed course. She taught at a middle school in a mid to high-income suburb of a greater metropolitan area. She participated in the watershed course during the summer of 2013.

Jenn taught eighth grade physical science to mixed level classes in a working-class town outside of a greater metropolitan area. She had been at the same school for nine years and it was the only school at which she’d taught. While Jenn felt the need to budget ahead of time for her
lab supplies due to department requirements, she did not feel as though her school financially limited her. She felt that the time constraints put upon her due to standardized testing limited her to some extent. She appreciated the practicality of the labs she was able to implement from the watershed course, with regard to their time and small financial requirements. She spent 4 ½ days on watershed curriculum with her students and took a limited number of students into the field for water sampling during free time. Jenn participated in the watershed course during the summer of 2013.

Michelle taught seventh grade life science at the same school as Liza, and had been teaching for eight years. She was in her eighth year teaching at her school at the time of the interview, and she felt that her school had many resources and did not limit her. She felt comfortable and supported by her administration and was confident in trying new things with her students. She participated in the watershed course in 2011 and had implemented the watershed course heavily into her course the first year over an almost two-week period, but in the following years spread her lessons out over the entire school year in order to more thoroughly incorporate the core concepts taught during the watershed course. She incorporated the philosophies of the watershed course into her teaching through all units. Michelle recommended the course to Liza.

Sally taught seventh grade life science at the same school as Jenn and recommended that Jenn take the watershed course. She had been teaching for seven years at the same school. Sally provided her students with three distinct lessons that she learned during the watershed course and used those lessons as reference points throughout different units during the rest of the school year. Sally incorporated the watershed course into her curriculum with her students every year since she took the course in 2012, and spent approximately two week’s worth of time each year in the implementation of that curriculum.
Sharon taught eleventh and twelfth grade marine biology and environmental science courses at the high school level for eight years. She had been teaching at the same school for those years, and was in an urban school which was the second most diverse in her state. She incorporated many aspects of what she learned in the watershed course into all of her classes throughout the year, and felt that the watershed course had given her the incentive to significantly change her entire curriculum. Sharon felt that she had flexibility in her curriculum because she taught elective courses and was not subjected to standardized testing preparations. She participated in the watershed course in 2012 and incorporated it into her classes every year, each year adding more components.

**Changes to Teacher Practice**

Teachers found that through their participation in the watershed professional development course they had significant changes to their teaching practice as a result. The first superordinate theme in this study refers to how teachers interpreted the professional development course experience and how their experiences impacted them once they returned to teaching in the classroom. Teachers found that significant changes occurred with regard to their curriculum content and many implemented directly from the watershed course lessons. Teachers also found that greater changes occurred in their teaching methodology, and that they related the ways in which they implemented curriculum to have changed through their experience participating in the watershed PD. Therefore, the nested themes are: *classroom teaching changes and course content changes.*

**Classroom Teaching Changes**

Even though the content of the watershed course was not directly used in Liza’s classroom after her participation, many changes occurred in her classroom as a result of her
participation in the watershed course. Liza spoke highly of the use of technology as a means for the students in the watershed course to communicate and access course content. The watershed course introduced its participants to Edmodo, an online social network for educational purposes that is similar to Facebook. “I was just able to . . . figure out the extent of how to use Edmodo with my kids. I really got into this for just even that part of the lesson which was fantastic.” Liza began using Edmodo regularly in her classroom with her students after learning about it from the watershed course.

She also noted a more significant change to her class as a result of her participation, which was the switch from her traditional lecture style to a more student-centered method. “In years past I had just used a lecture format . . . of course, I wouldn’t have liked that either; they didn’t really enjoy it at all. Adding this lesson to my unit was great . . . it absolutely completely replaced the lecture portion of that unit and made that part of my unit a lot more fun and engaging.”

Through her collaborative efforts she was able to pass on what she learned to other teachers in her school. “. . . a lot of them do it too.” Collaboration was a large component of the watershed course and like Liza, many teachers found themselves working and sharing more often with coworkers after their participation in the course.

Jenn found that one of the best things she took from the watershed course was the multitude of labs that she would now do with her students. She described them as “doable and chunkable,” which was important to her since her class periods lasted only 32 minutes. “So many of the idea books that come along with our text series . . . the labs are geared for longer periods of time . . . the [watershed course] staff had just a really good handle coming up with activities that show kids more . . .” She felt strongly that the faculty and staff that implemented the course
understood the needs of their participants and worked with them to ensure that they were well prepared for implementing new things into their classrooms. “I can’t say enough good things about the staff and the teacher resource center down there in terms of lending and willing to go out of their way for you.”

As a result of the new materials and coursework, Jenn mentioned that her class had changed quite a bit, and the labs that they were doing in class allowed students to “bolster their lab skills” as well as their “analytical thinking skills.” She attributed this to the fact that students were able to perform more labs in her classes.

After participating in the watershed course, Michelle reported feeling “re-excited to teach” because she had found a new way of looking at things. She reported a change in her overall approach to teaching and described what she referred to as “the real world and real life” approach. While she stated that she had already done that to some extent before she took the course, she felt that “it made me that much more invested in it because I was reminded of how important it is for the students to be aware of what’s going on out in the world and how it applies to science.” She also reported feeling more encouraging of kids’ participation in outdoor class activities as a result of the watershed course. “I don’t know if I would be encouraging them to be outside in their environment and being aware of what’s going on around them as much as I am now . . .” Overall, Michelle felt their were many changes to her classroom as a result of her participation in the watershed course.

Sally stated that the watershed class was “. . . one of the best classes I’ve ever taken,” and referred to the number of labs that she obtained that could be used in her classes at a later time. She also felt confirmation in that her methodologies were supported by the watershed course. “I feel like it more reaffirmed how I teach.” Her classroom teaching saw significant
changes as a result of her participation, primarily in the connectedness she started to incorporate across the curriculum. This overlapped into the greater sense of stewardship that she built within her classroom.

Sharon’s teaching style shifted as she moved away from teaching in her actual classroom to working more continuously in the field with students. She discussed this switch and spoke of the field location as being “like a classroom”, and the importance of repetition of going to an area and seeing how it changes. These changes occurred across the board for her, as she mentioned that she was taking kids into the field regularly in all of her courses, not just in marine biology. The students became very accustomed to having class outside, and were often disappointed when they couldn’t go. “Sometimes they’re really excited and want to go, and then I’m like, no wait, we can’t we have a test tomorrow, and they’re like ‘Ahh!’”

Through taking her students into the field on a regular basis, she gained the support of administration and began working collaboratively with her colleagues. “My principal is very involved . . . I’ve had two colleagues join me with their environmental science classes, and so that was one of the most productive [classes] for me.” These collaborations improved the class experience overall. “They were able to see what I do, and then give me feedback, and help with activities that we were doing, so it went really smoothly.

**Course Content Changes**

Liza originally signed up for the watershed course as a way for her to build her curriculum, but was unsure whether it would be the right fit for her. “It was actually something that was . . . that made me hesitant to sign up for it . . . again it really doesn’t center itself in middle school science.” She found that through taking the course she was able to gain many ideas, but has not directly integrated any of the course lessons directly into her class. Despite her
lack of connection with the course content, she found the course to be beneficial to her because of the lesson she designed for her students as her final project assignment in the course. “I feel like they really benefit from it and I’m able to do a couple more in-depth lessons and they already have that basic knowledge . . .”

Liza mentioned that she would like to incorporate more from the watershed course into her classes but felt limited in doing so due to her feelings of constantly lacking in time, as well as the fact that she felt the watershed course “is not part of any standards that middle school needs to fulfill.”

In working to ensure that students were prepared for potential changes in standardized testing as well as with the goal of having students appreciate science, Jenn sought a more diversified curriculum for her physical science students than average. Because of this she implemented the watershed course into her curriculum in a few ways. By connecting to a particular strand of her curriculum, Jenn incorporated a water testing lab which showed students how pollutants in water due to human activity “can become finely dissolved in water that they can’t even see that they’re there unless they test for something.” By making this connection between the watershed lab and the curriculum strand she was able to cover her course requirements while maintaining a sense of connection for her students to their local environment and impacts.

Jenn referred to the importance of having labs that both worked with her timeframe and were affordable. She noted that the watershed course introduced her to a number of labs that “can be done within a reasonable timeframe, and without heavy dollar investment . . . These lab activities were fantastic in that regard.” While she felt like her curriculum limited the amount of time she could spend doing lab work with her students, she attributed her increased lab activities
and experiments to the watershed course. “This [her participation in the watershed course] is why we do more labs.”

During the first school year following participation in the watershed course, Michelle felt compelled to include many of the things she had just learned into her curriculum. Over the next few years she changed things a bit. “Yeah, I didn’t carry all of it over into the next year because it did take up a lot . . . obviously, almost two weeks of stuff right there.” She found that it was more important to spread out the lessons that she’d gotten from the watershed course over the entirety of the school year. “Then I realized because they had such an incredible reaction to it, that I should really spread it out and revisit it.”

As her course evolved she began to incorporate some of the major themes that were stressed during her watershed course experience and discussed them over the year. “Now I spread them out where we talk about 1 or 2 in each unit . . . we do it a lot more in depth together as a class.” By incorporating these themes, Michelle’s curriculum has changed to feel as though each unit is part of something larger. “. . . I feel like all my units even though they’re separate units they really feel like one big unit.” Michelle felt as though her participation in the watershed course helped her to make foundational changes to her curriculum.

Sally felt that her participation in the watershed course led her to make great changes in her curriculum. “The summer I took the watershed class, I was starting that unit in September, so I had never taught ecology before. But I can honestly say if I hadn’t taken the watershed class, I would’ve never focused on aquatic ecosystems or even watersheds in general.” She found that while watersheds were considered a topic in her course’s textbook, there was minimal coverage of the topic. “. . . it’s such a minor part of the textbook that I feel like it really wouldn’t have crossed my mind to even have included it.”
Similar to Michelle, Sally used a lot of the concepts she learned in the watershed course to show relationships between her units and how they connect to one another throughout the year. I think because we not only start the year with this, but because it is such a water-based theme, I try to incorporate that into- not everything we do- but even when we talk about classification, we talk about some of the plants and animals we’ve seen . . . it’s kind of like a common theme throughout the year.

Over the course of three years, Sharon found herself adding more and more to her curriculum from the watershed course until it became the mainstay of her entire yearlong course. “I definitely try to go outside as much as possible, and I’ve made it a huge part of the course . . .” Sharon incorporated the field experience aspect to her course as a means to engage students, and it has become a regular event in her class. In her third year of implementation she had already spent six weeks integrating watershed curriculum into her course, and she had only been in school for approximately ten weeks at the time of the interview. She intended to continue taking her students into the field, and felt she would not have been able to do so without the influence of the watershed course.

**Student Connection Building**

The second superordinate theme that emerged in this study demonstrated that through the lessons that teachers provided from the watershed course, students made connections to their educational experiences. Connections in this case refer to the way in which the students were perceived to relate to the learning experience they had, and how they appeared to interpret what they were learning. The researcher found three specific areas in which these connections could be further examined and identified. Therefore, the three nested themes for this theme are:

*engagement, finding meaning and relevance, and place-based learning.*
Engagement

The participants in this study found that they were able to increase their students’ level of engagement through the incorporation of lessons, units or full course changes as a result of their participation in the watershed course. The level of engagement among students appears to have varied from teacher to teacher, with relation to the type of lesson implemented, their ability to study in the field, and the activities done in the classroom. Each teacher found a different way of interpreting student engagement.

Liza indicated that upon implementation of the lesson that she created for the watershed course, her students reacted well and appeared focused and challenged. As her lesson incorporated a 15-minute video, Liza measured student engagement through indications that they were interested in the movie. “They weren’t chatting with their friends, they weren’t drawing on the desks. They were definitely - the video was engaging and they were - it was also more challenging.” Another reason why she believes the students were engaged is because she interested them with new concepts. “These were the types of relationships the kids had never seen before. They thought not only were the relationships cool, but the organisms were really cool as well.”

Jenn’s lessons were done over a 4 ½ day period, and incorporated a focus on the local environment. In referring to the students’ level of engagement, she found it somewhat difficult to quantify as it was outside of her usual scientific method of measurement. “This sounds very unscientific, and given my background it’s a big change from engineering, but it’s more subjective than quantitative . . . it’s a more direct level of excitement in the class, the questions the kids ask, things that they bring up.” Students were engaged in Jenn’s class due to the buy-in she obtained from the students on the first day. Jenn paired students together that had
participated in a watershed field trip the year before (as part of Sally’s course) with those that hadn’t, and then proceeded to introduce basic concepts of the watershed, with an understanding of how their own actions impacted their local watershed. “That’s where I got the buy-in and the excitement going to for whole unit. It was amazing.” She felt that excitement carried over for the duration of her unit. Another indication that her students were engaged with her lessons was the out-of-class time that she spent with some of them. Many students indicated to her that they would like to collect water during free time so that they could test it back in the laboratory. This kind of interest from a seventh grade student is not typical, and largely indicative of their above average level of interest and engagement in the course.

Teachers had the option to participate in the watershed course during three consecutive summers. Therefore, some teachers have had a longer time than others to incorporate what they had learned in the course in different ways into their classrooms. Michelle is an example of a teacher that found a variety of ways to implement the watershed course into her curriculum, and identified multiple ways in which students were engaged with their learning experience. After the summer that Michelle participated in the watershed course, she heavily implemented what she learned during a two-week unit with her students at the beginning of the year. During that time she found that the students were extremely engaged with the lessons she provided them as indicated by their level of questioning. “Every student was really eager to get their questions down and put them up on the board. I didn’t have any students that didn’t participate in it.” She also found that her students completed 100% of the work done during this time, and that every student participated, a significant indication of engagement. While out in the field, she broke students into two large groups, and one of those groups worked independently while the other worked directly with her testing water at their local stream. She found that the students that
worked independently did so in a quiet and reflective manner, indicating that they were invested in the work they were doing. To Michelle, this indicated a high level of engagement. In the following years Michelle spread out her unit to discuss the topics throughout the year rather than only at the beginning. By spreading them out, Michelle found that she was better able to continue keeping the students engaged with the subject. She found their interest did not subside during the rest of the year as students regularly inquired about when they would be going back to collect water samples as the seasons changed.

Some teachers are able to measure the level of their student’s engagement through their discussions with each other, and Sally’s students worked in groups in which she found them spontaneously debating. “I love to hear when they’re debating what should go where and why. I feel like that’s when I can tell that they’re really thinking and engaged more.” Her students were also tasked with having to interpret what they’d learned through drawing, and she found that “the pictures that they do at the end kind of show me that they’re watching carefully and understanding that too.” Sally felt that her students were most engaged with her classes through their enthusiasm, which she attributes to the fact that students performed authentic science tasks in her courses. “This sounds awful, but this is really the first that they’ve had a true science class on their own. So any time that we get to do anything hands-on, they’re generally not used to doing that so they love it.” She discussed that the students retain their interest through their abilities in her class to pose a question and attempt to answer it themselves, and this method of teaching created a high level of engagement throughout her school year.

While the previously mentioned teachers were middle school level, Sharon taught at the upper high school level. Indications of engagement were somewhat different than those of the middle school students’, but no less significant. In teaching electives, Sharon had the flexibility
within her curriculum to implement as much or as little of the watershed course as she chose. Her interview took place during her third year of watershed course implementation, and by that time she had incorporated her lessons over the course of the full school year. Sharon found that by taking students out into the field multiple times over the course of the year, she was able to more deeply connect students and engage them.

I think that’s why I keep doing it, is that I see more engagement and excitement of just going outside and being outside of the four walls of rooms and desks. Especially the water, when there’s so many things underneath you that you can’t see, I just feel as though kids are engaged in the unknown.

She also found that through her own research as part of her graduate thesis, her inclusion of the watershed curriculum, and students’ engagement as a result, led to increased test and labs scores. Sharon attributed this directly to the connections the students formed with the watershed lessons and curriculum.

**Finding Meaning and Relevance**

Many of the teachers in this study discussed the importance of creating personal connections between students and lessons by demonstrating the ways in which they connected directly and personally with the topic. Teachers spoke to the ways in which they helped their students to build these connections through the understanding of the relevance it had in their lives. Alternatively, a few spoke to the importance of providing students with the opportunities to understand these connections, but felt constrained to do so in their classrooms.

Liza indicated the importance of teaching about topics that matter in the students’ daily lives, but struggled with the strong time limitations she felt due to standardized testing. “I don’t think I have time to add that [additional components to her unit]. It would be awesome if I could.”
She felt that students would have made deeper connections if she had the time to be able to expand her unit and include more of the things that she learned in the watershed course. “How can I add all of these great resources for them, but still focus on the terrestrial stuff that I know they’re going to be required to know?” She seemed somewhat frustrated to feel these limitations, and mentioned that she had great ideas that would allow students to further incorporate lessons of meaning and relevance, but due to limitations could not implement them. “That was really cool . . . but that would take up an entire day.” Overall, she intended to incorporate more lessons with relevance in students’ lives in the future. “I hope that I can have extra time to add more water-focused lessons because it is definitely important and it definitely impacts my students’ lives.”

The students in Jenn’s classes were given a homework assignment on their first day of their watershed unit to figure out how their actions at home related to what they spoke about in class. Jenn found that the students not only felt connected to this assignment, but also took it to new levels that she did not expect.

They kept referring to what they saw there. I actually had one student whose dad works for the city, when we were looking at salinity, go and find out what was the percentage makeup of salt in the road salt for the city. Another kid saying, you just make the connection between if one house puts this stuff into the water accidentally, or being unaware, just looking at what collectively all the people in his neighborhood do.

Jenn was able to show students how their lives related to the topics they were learning in the classroom, and as a result she found that the students gained a greater appreciation for what they were learning. She struggled with limitations due to time constraints as the result of preparing for standardized testing, and felt that the students should have more time in order to do
similar lessons that would build on the concepts of meaning and relevance.

In addition to covering what we need to in terms of the state framework for physical science, we need to do a pretty extensive review of the sixth and seventh grade content. And given that, it can change the amount of lab work we can do. There’s no getting around it. We try to incorporate as much as we can, and you try to go as deep as you can, but the time constraints are very real.

Despite the limitations Jenn felt, she felt strongly that the work they were doing was helping these students to further understand their personal connection to the class work. “. . . the more you can give them a reason to care about what they’re learning, and at that age it’s not as much an intellectual connection as an emotional connection. For them just to be able to associate impact on animals . . . gives them a reason to get really into it.”

Although Michelle taught at the same school and grade as Liza, she felt that she had very little limitations put upon her, and was able to thoroughly implement a curriculum into her course, which built on the meaning and relevance that the students found within her unit. Michelle’s lessons incorporated 1) a student field trip in which students observed human impacts, 2) a speaker from a local watershed group who answered students’ questions directly, and 3) a follow-up lab opportunity in the spring, which allowed students to design their own experiments in order to test hypotheses they developed while studying the watershed. “. . . the ones who sometimes didn’t normally get that type of challenge really found it exciting and did some really neat experiments I think . . .” Through these things, Michelle felt strongly that students were connecting with what they were learning due to the personal connections being made, and heard comments from students, such as “‘Oh, now I know why pH is important.’”

She referred to the student interest over the year in relation to how much they cared about
the subject matter, and discussed the connections the students made during this time:

I try and take two days with sometimes a week at the end of each unit to talk about these things. I think it’s really important but it makes them care about the topic of science and what’s around them more. That’s why in my first year I spent a ton of time front-loading it, and then I didn’t really touch on it as much throughout the year. Then I realized because they had such an incredible reaction to it, that I should really spread it out and revisit it. I spent a lot of time my first year being like ‘Oh, I’m going to cover answer that in cell biology’, or, ‘I’m going to answer that in evolution.’ Then I realized I’m telling them all right then, and telling them ‘oh you’ll figure it out later.’ I could then introduce it and have them better realize the connection for themselves.

In the spring the students made a children’s storybook and this demonstrated to Michelle that the students understood how their coursework had meaning and relevance in their own lives. “In the last two years those books have been really reflective, and really showing that the students are understanding how this concept relates to them.”

Michelle found that by incorporating topics and concepts that the students can relate to, they built strong connections that lasted beyond the usual length of the unit.

I’ve [taken] what I’ve learned in that watershed class . . . and really tried to make it ‘Yeah, sure this happens in the tundra, but let’s look what’s happening right outside the school. Let’s look at what’s happening right in Boston Harbor.’ I think that without question that makes them more excited, and I also think that it’s something that gives them a connection. It lets them carry that content through the year. I feel like they’re a lot better at talking about what they learned in ecology in May because they have this, they can be like ‘What did we learn in September? Oh we were doing water testing. Why were we
doing water testing? Oh because we were learning about the environment.’

Through the personal connections she helped students build, students were able to form an understanding of what the lessons meant to their own lives, and how their actions directly impacted their surrounding environment.

Sally spent approximately two weeks per year incorporating watershed lessons into her curriculum, and does what could be described as a slow build up to getting the kids to understand their personal connection to the unit. “. . . it gets them starting to think about how their actions kind of affect other areas. . . I feel like it starts to get the ball rolling.”

Sally’s town has a unique history with regard to water pollution, and a major motion picture was created based on her town’s history. Interestingly, Sally found that most students had no idea about the town’s history. “They don’t know it at all. I feel like, from year to year, they really don’t know what the history is with (town name) and water and all that kind of stuff.” She attributes this to the disconnection that students have to their local environments. “The kids are so disconnected from the natural world around them. They’re really- most of them are really not comfortable outside. They really don’t know how their actions impact anything around them.”

Sally has worked to overcome this mentality with her students, and over time, through the introduction of these lessons to her students she has found that students have developed a sense of meaning and relevance with the subject in their own lives. “So I think a lot of them do make some good connections between ‘Oh I’ve been to the Mystic Lake before’ or ‘Oh I’ve been wherever’ and didn't realize that these are all the living things that are there, this is how we impact those areas, and that we’re all connected in that way as well.” Students have applied some of what they learned directly to their home environments. “In terms of the invasive species that we see when we’re there, they often start to recognize a lot of the plants that they have in their
own yard. They’re starting to be aware of the- I guess more plant life- that surrounds them, as well as connecting it to what’s in the pond, what we have near our school, and then what they have at home.’

Extending beyond her classroom many students felt compelled to do more, and became student volunteers for their local environmental network. “I usually have a group who feels so strongly about, you know, we need to start taking care of our pond. So there’s always a group that wants to do more.” She found that between 10-15% of her students had gone on to volunteer after their participation in her course, a strong indicator that what they learned in class created a sense of meaning and relevance in their lives.

Students in Sharon’s classes developed a long-term relationship with their local environment, which helped them to form a connection to a local area in their town. Sharon took students into the field on a regular basis, which she felt helped the students build an understanding of their place in the local watershed. “[Taking students to the local river] made certain concepts stick or made them have certain connections to their home or their town that they may not have had otherwise. And so that just kind of stuck with me and I just kind of kept building off of that.”

By bringing students into the field throughout the school year, Sharon had the opportunity to continue building those connections with students, and one of the aspects that she discussed was the authentic lab experience that the students received.

. . . it’s like a true science field lab experience. Because when you're in college, there’s a three hour lab that’s connected to every science class, and that is usually in the field . . . So I’m trying to make it as authentic as possible, and maybe hear more students are studying science in college because I have a lot of juniors and seniors that are making
these decisions.

Through the incorporation of what Sharon perceived as a more authentic experience for her students, she was able to provide students with a more relevant experience, and found students connected more deeply with her course. Sharon related to her students in this way, as she felt that the watershed course taught her how to bring kids out into the field in a meaningful and authentic way.

“We went and we actually did all the things that we could do with our own classes . . . I got a lot more tie-ins by going to the watershed course and people were able to speak from their experiences because there were a few teachers there that take their kids out into the field . . . I was able to alter what I did, and kind of incorporate all of their activities too.

Through the hands-on approach of the watershed course Sharon felt more comfortable in implementing her outdoor curriculum, and felt that without having had that experience her course would have been taught much differently. “I don’t think I would have done it, actually . . . Or, it just might have been more scattered and less structured than it has been.”

**Place-based Learning**

Four of the five teachers were able to incorporate place-based learning by taking students to a field site of study outside of their regular learning environment for their watershed curriculum implementation. Teachers reported that this experience greatly enhanced the experience for their students, and through these trips the students were able to build deeper connections to the lessons in which they were participating. While some teachers had more flexibility than others in their implementation of field-based study, all felt that there were benefits to taking the students into the field.
Although Liza remarked about the benefits other teachers had with bringing students out into the field (“I have a coworker who has done it and he loves it and the kids love it”), she has not been able to take her kids out of the classroom for a field-based experience. She attributed this, in part, to the challenges she would face. “It’s difficult for me to picture bringing kids into the field. I have middle schoolers and it’s a behavior management piece- it’s always forefront in my mind, how to get middle schoolers to do this and to find it meaningful.” Liza remarked throughout the interview about the confidence issues she had and anxiety she felt regarding the need to complete her required curriculum, and commented on her feelings of being new. She remarked that she was not yet confident in adding new things to her curriculum, but added “they could benefit more if I was able to add more to my lesson.”

Jenn found that she was unable to take students into the field as a class, but implemented place-based learning for a few interested students. “We went out with that small group and got water samples from a nearby stream . . . That was great because the kids got a chance to do some stuff more hands-on in that regard. Overall they responded very well.” She remarked that time was a factor for her and that, although she would “build in more work of this nature” into her curriculum if she could, she did not refer to including a class field trip to a field location as one of the missing items. She felt that students made deep connections regardless of their lack of time in the field, and has continued to build those connections and encouraged students to explore further on their own. Due to her abilities to connect these students with her curriculum, she found that students began making connections to her lessons on their own. “I’ve had kids choose as a science project visiting the aquarium itself and interviewing people behind the scenes for their science project.” She was able to encourage place-based learning even though she could not provide the opportunity to do so herself.
Michelle felt that the fieldwork done by her students was a necessary component to building the students’ connections to their local environment, and although she had classroom activities which modeled their local setting, she did not feel this was enough. “Of course they loved making them [3D models of the watershed], but I don’t think that it really helped them visualize anymore what a watershed was. I thought taking them outside and showing them the topography where the actual water was collecting was more beneficial.” She found her student’s level of excitement built throughout the year as they continued to inquire about their next field experience. “Originally my goal was to do it every season (take students to their field location for water testing) to see how it changed, and the fact that they would be asking me every week, ‘Is it time to test the water again?’ They were really interested in that.” Michelle used her place-based experiences with her students to further connect students with their local environments by helping them to understand the connectedness of the environments in which they visited.

They’ve never taken the time to sit there and look at it for 45 minutes and think about what does it mean that there’s a golf course right next to this and every time it rains, everything from the golf course drains into this water. I think that’s why, even now, I try to take two days with sometimes a week at the end of each unit to talk about these things. I think it’s really important, but it also makes them care about the topic of science and what’s around them more.

Michelle directly demonstrated how a local environment in which they regularly visited could be impacted through the actions of those around it, and by doing so, was able to build the connections that students felt for these places. “The biggest thing I still use from that class [the watershed course] is the getting them outside and observing the topography and the environment around them.”
Sally found that students were disconnected from their environment and by bringing kids out to a local pond with a guide, she was able to build their enthusiasm and interest in this area. “It’s just really deep thinking about how the land- especially at one pond, has just changed over time . . .” Students spent the day at the pond near their school, and although this trip was not done over multiple visits, Sally found that this place-based learning experience helped the students create significant connections with their local environment.

Aside from her full day field trip to the pond Sally regularly took students outside to familiarize them with their local environment. Through these regular visits students became more comfortable with the idea of being outside and in a different environment, which helped them to build a connection to their local setting.

We start the unit . . . by going outside. There’s not a lot around us at the school, but I take them on walks outside, we start to get familiar with the plants and animals that we see. I think just from starting there . . . I feel like they have a much greater sense of stewardship, and just a much greater sense of connectedness to not just other towns around us but really how they see the whole state and the whole country kind of being connected at the end.

Students in Sharon’s class were regularly brought into the field during their time in her course throughout the year. Sharon described how her experience with the watershed course enabled her to build her personal work in her Master’s thesis, which focused on “having kids create a connection with their own environment and their own town.” Because the watershed course taught her how to bring students into the field, she was able to successfully implement multiple trips throughout the school year, continuing to help students build connections to their local environments. She found that many students appreciated that they were able to visit their
field site many times, and commented that “. . . a lot of field trips are just like at a museum, and you just go for this one time thing, where this was a continuation of something that they were applying and it was relevant and near us.”

Sharon felt compelled to use place-based learning to help students overcome what she described as a disconnection. “So many kids just are on their phones and on their computers and don’t even go outside, so just be outside and see they are living in a classroom, they just need to know where to look, that is important to me.” Since she had the ability to take students into the field on a regular basis, she was able to get the students to explore an area that they might never have known was there. “I think it was important for me to get the kids just somewhere in their town which I knew they didn’t know existed.”

**Long Term Impacts**

Through a variety of ways, teachers implemented what they learned during the watershed course into their classrooms. Through the connections that were made by students, as well as the changes in curriculum and teaching methodology that teachers reported had occurred as a direct result of their participation in the watershed course, all teachers in this study reported that there were long term impacts made on the part of both the teacher and the student as a result. Many teachers felt that the watershed course impacted them in a deep way, altering how they perceived themselves as teachers and how they approached their teaching methodology. All teachers reported that their students were impacted in some way by and through their participation in the course, and most teachers found these impacts to be significant.

**Long Term Impacts to Teachers**

Liza mentioned many times that she felt like a first-year teacher but explained that through taking the watershed course she was given many new insights into how to incorporate
more of the desired lab activities into her classroom. “I’m always thinking about how I can add more ocean-focused lessons, so I am thinking about it.”

Jenn felt that the impacts to her as a result of taking the watershed course were continuous. “It’s an ongoing process.” She felt that the watershed course helped her to obtain lab activities, ideas and resources that she planned to continue working with for years to come. She spoke to the fact that there were certain ideas that she wanted to implement into her classes, but didn’t have those particular ideas formulated yet. “It’s [given] me more stuff to do that I already knew I wanted to do in class.” Jenn mentioned that the course had positively impacted her through “both the ability to incorporate what I’m learning in my classroom, plus the personal knowledge.” This course encouraged Jenn to take similar classes through the same organization in the future.

In a broader sense, Michelle reported that the watershed course helped her to see professional development lessons differently. She discussed the fact that prior to taking the watershed course, when she had professional development courses that didn’t apply to her, she was dismissive of the content and turned off. She described how one of the teachers of the watershed course helped her to change her perspective:

She was able to say to me, and to the people that were like, ‘I’m never going to do this density lab. Why do this? I teach life science?’ She would then say, ‘well what if you were explaining global warming, and you wanted to talk about why the glacier was melting and how it might affect density. Then you might do it.’ I think having instructors that are able to model . . .showing that it’s not just cut and dry . . .now every class that I take, I approach it that way . . .”

Keeping with this mentality, Michelle changed how she approached her courses
To try to help students to see things in the same way. “I do think it’s important to show the 6th grade science and the 8th grade science do apply to 7th grade.”

The watershed course, in conjunction with a supportive administration, allowed her to feel comfortable in trying new things without worry of failure. “. . . being honest with your students about it, and not being afraid to say, ‘This is the first time I’ve ever done this. Let me know if this makes no sense, or you hate it, or something like that’, is something really important too because then actually they’re more patient with you.” Because of these things, Michelle felt that her participation in the watershed course impacted her both in the way she approached new information and course development, and with the methods she used to provide an effective learning environment.

Sally left the watershed course feeling as though she had numerous ways in which she could change her classes and implement new material. “I feel like so many of the activities that were presented to us, not only by the staff there, but by the other teachers that created their own lessons, I’ve either used or kept on the back burner.” She remarked that the watershed course made a great impact on her due to the ways in which it’s helped her. “I’ve taken a lot of professional development classes and I mean most of them I feel like I don’t really use . . . but this is one of the best classes I’ve ever taken. It was really useful.” While Sally was already confident in her teaching approach, she found it welcoming that the watershed course confirmed her beliefs. “I feel like it more reaffirmed how I teach.”

Sharon found that the watershed course helped her in both personal and professional ways. Through her implementation of an entire year’s worth of outdoor curriculum, Sharon felt strongly that her participation in the watershed course helped her to implement new curriculum in a way that helped define her as a teacher. “Since I’m implementing it [the watershed course
content and lessons] on a regular basis, I think it kind of forms me as an educator.”

By being provided with the knowledge on how to take students into the field in a meaningful way, Sharon was able to use the field experience to complete her research for her master’s degree. She was able to use what she learned in the watershed course to direct her master’s thesis, which focused on place-based education. “I was mostly focusing on having the kids create a connection with their own environment and their own town, finding their place, whatever that might be.”

Overall Sharon felt that one of the greatest impacts the watershed course had on her was the excitement it created to try something new.

I technically don’t have to change the curriculum. I’ve been teaching for eight years, so I could just keep doing the same thing over and over again. But it was exciting to hear all these different things I could do. Like, wow. I’ve always had the idea of going outside but maybe didn’t really know how to do it, so I was excited and appreciative of taking the class and having the opportunity and field resources to make it all happen.

**Long Term Impacts to Students**

Liza implemented a one-day lesson into her curriculum, and found that she couldn’t gauge whether students had been impacted by it over the long term or not. However, she felt that this lesson was relevant to their learning, and that it had a “decently long impact.” She commented that if she had more time built into her course, “then it’s quite possible that they would remember some of the stuff that we talked about.” All in all, Liza felt that the lesson she implemented into her classrooms was very worthwhile, but stated, “I don't know what they remember now looking a month after.”

Jenn felt confident that her watershed curriculum made a strong impact with her students,
due to the ways in which they referenced the unit throughout the year. She was impressed that they were able to recall the details of the unit. “We’re talking eighth graders, eighth grade attention span, and this is going from mid, late spring going back to what they had done in November!” She felt that this was a good indication of the impacts it made on them. She was also confident that some of the main ideas impressed upon the students had made an impact as well. “They may not be able to explain all the nitty-gritty details but big size kind of thing,” and added, “They’re retaining at least the big ideas of what they’ve learned.”

Many students maintained an interest in what they had learned, and this was evident later in the school year when students were designing science fair projects. Many of Jenn’s students chose to go to the aquarium and interview people behind the scenes for their projects. Jenn attributed this to the fact that the watershed curriculum had gotten them “thinking more about the ocean.”

Michelle was able to learn from other teachers in her school that her course was having an impact on her students. “I do hear from other teachers that a student will bring something up, maybe in social studies, and they’re talking about cultures that live by the ocean and why . . .” She thinks that the impacts of her course carried over for at least the duration of the school year for her students, but knew that in some cases students were impacted more deeply. “I had a student who got really into when we talked about habitat destruction. I talked about coral reefs, bleaching effects on coral reefs, and I think he is going to remember every time he goes on a vacation. For him that’s the one thing that really resonated . . .” Michelle reflected on her own personal science class experience as a seventh grader and felt that nothing she learned during that time really resonated with her, and therefore, she made it a goal of hers to “get them to remember 1 or 2 things and feel really strongly about it . . .” She believed that she was successful in
achieving that goal. “At least one thing that we talked about in that year will stick with them.”

Given the unique town history where Sally taught, she learned that her lessons had impacts on her students and their families. Through educating her students about the environmental issues the town had faced in the past, she found that many students had personally connected with her lessons through discussions at home. “I have kids who come up to me a couple days later and say ‘Oh, I was telling my parents and they knew so and so who unfortunately lost someone due to that, or knew someone who was affected by that.” Sally felt that the significant personal connection the students had to the area and history were part of the reason that the students would continue to recall their lessons in the future. “ . . . from what we’ve done and what we’ve talked about in [town name] and what’s happened in [town name] in the 70s with the canneries and everything, I have to just guess that it made an impact. I’m sure the kids remember.” At the completion of her unit, 10-15% of her students went on to become volunteers with their local watershed group, a great indication that her course had made a deeper impact on those students.

Although Sharon felt that it was difficult to gauge high school students’ reactions to her curriculum, she was able to identify how many of her students had been impacted through their studies in her course. In writing college recommendation letters for students, Sharon was able to read student answers and found that many students spoke of the impacts their time at the water had on them. She mentioned that after school she coached the crew team, and students from her class often had questions for her with regard to the watershed while on her crew boats during practice. Sharon found that many of her students were internalizing what they had learned. She hoped that what she was doing with them in class would direct their studies further on in life. “I’m trying to make it as authentic as possible, and maybe hear more students are studying
Chapter 5: Discussion

The purpose of this research study was to investigate the experience of teachers after their participation in an experiential education professional development course (an overview of this course may be found on page 40). The researcher performed an interpretative phenomenological analysis, which enabled her to better understand the experience had by the participants while taking the course and once they returned to the classroom to implement what they had learned. Due to the experiential nature of the course, the experiential learning model developed by David Kolb (1984) provided a lens to further examine the participants’ experiences.

The research question this study sought to answer was: How do teachers benefit, and how do teachers perceive their students benefit, after their participation in an experiential education professional development course? This study relied on the accounts of the teacher participants to further understand their personal experience, and to gain an understanding of the student experience through the teachers’ perceptions. This study did not speak to or communicate with the students of the teachers.

This chapter begins with a discussion of the professional development program in which teachers participated with regard to its position in the literature. It proceeds by discussing the superordinate themes that emerged from this study. They were 1) changes in teacher practice, 2) student connection building, and 3) long lasting impacts. Suggestions for future research are offered after this discussion.

Providing an Effective Professional Development Course for Teachers

Most teachers find professional development courses to be ineffective and do not lead to change in the classroom (Gulamhussein, 2013, Hanushek, 2005, Opfer & Pedder, 2011). In the
case of this experiential education professional development course, this research uncovered that all teachers made changes in some way to their curriculum as a result of their participation. By having such a significant impact it is clear that the watershed course provided an effective professional development opportunity for its teacher participants. This discussion focuses on the elements that contributed to its effectiveness.

Aspects from the course that specifically impacted teachers included the way that the instructors provided modeling of content, followed by active experimentation. Modeling is an effective teaching practice that encourages learning (NRC, 2005), and by instructing in this way, the participants were able to take control of their learning (Zarrella, 2011). The professional development course overcame a major barrier to successful professional development implementation by modeling the activities for its participants (Gulamhussein, 2013). By providing active modeling and then encouraging teachers to do the activities themselves, this course aligned well with Kolb’s (1984) experiential learning model by accessing all four modes and allowing participants the ability to fully understand and self discover the ways in which the lab activities worked.

Professional training, development and learning often occur in isolation (Beard & Wilson, 2006), but in this study teachers commented on how they felt supported by the instructors of the course, and enjoyed the collaboration that happened often between them and their fellow participants. One of the barriers to successful professional development is the inability to engage teachers (Gulamhussein, 2013) but it was clear through their descriptions that teachers felt very engaged through interaction and sharing ideas.

The watershed course took place over three days and required teachers to return for callbacks later in the school year so that they could share findings with their fellow teachers. In
providing such an extended timeline, this course was able to easily overcome another major pitfall of professional development, which is the brevity in which most courses are run. Most courses are too short to be effective (Johnson, 2007), and by incorporating such a lengthy period of time, teachers had the time they needed to work on, change and hone their ideas and plans.

One of the most significant aspects of the watershed course that allowed teachers to feel engaged was the relevance it provided in offering real world insights. It has been asserted that the best learning opportunities take place when there are real world implications for the learner (Itin, 1999, Klosterman & Sadler, 2010, Okada & Tada, 2014). By providing a learning experience for teachers that they could relate to and care about, teachers were able to easily understand why these lessons had relevance for their own students, and thus, translate the experiences they had into relevant classroom lessons.

Changes to Teacher Practice

Because of the ways in which the watershed course addressed and overcame many typical obstacles found with traditional professional development, including lack of preparation time, classroom management issues, assessment ability and mess (Johnson, 2007, Allison and Wurdinger, 2005), it is unsurprising that teachers felt compelled to change their teaching and incorporate what they had learned into their classrooms. Through participation in the watershed professional development course, all teachers reported a change to their courses in some way (and some in very significant ways). This is significant, given that most professional development leads to no change in the classroom (Gulamhussein, 2013). While it’s important to note that some of these teachers were taking the watershed course with the intention of finding new ways to make change in their classrooms, others were taking it as a way to increase their graduate credits and had no intention of making change. Teachers were likely more inclined to
make changes due to the ways in which they themselves connected with the lessons taught during the watershed course. The experiential learning model supports this change to practice, as it correlates with the fourth learning mode (active experimentation) and would demonstrate an active change after a transformative learning experience (Kolb, 1984).

**Adapting the Experiential Learning Model for Identification in the Classroom**

In an effort to make the experiential learning model more accessible to educators, Harb et al. (1993) set out to identify ways in which the model could be easily recognized within a classroom learning experience. In providing examples of classroom activities which align with aspects of the experiential learning model, Harb et al. has provided educators with tools they can use to more readily identify areas within their own curriculum and methodology that agree with the four modes of the learning model (1993). In seeking to understand how the students of teachers in this study benefitted from their classroom experiences, the four-stage cycle of the experiential learning model as modified by Harb et al. (1993) is used as a guide to examine the lessons implemented by the teachers. The identifiers that Harb et al. have selected relate closely to indicators of experiential learning. For learning to occur, an experience should provide the opportunities for the student to engage with the various aspects of the Kolb learning model, with particular regard for student engagement, action and reflection (Kolb, 1984), and students must make the connections themselves in order for effective learning to take place (Roberts, 2002). In doing so, students will be active participants in their learning, one of the core tenets of experiential education theory (Dewey, 1938).

Harb et al. (1993) identified classroom markers that demonstrate a focus on each the four modes of the learning model (see table one), and further broke the model into quadrants in order to identify the movement and passage from one mode to the next (see figure two). These four
quadrants represent the passage from the concrete experience to reflective observation (quadrant one), reflective observation to abstract conceptualization (quadrant two), abstract conceptualization to active experimentation (quadrant three), and active experimentation to concrete experience (quadrant four) (1993). Each quadrant also has specific objectives for the teacher to strive to achieve in order to provide an effective learning opportunity for their students.

In quadrant one, teaching objectives included providing the big picture, providing meaning, generating enthusiasm and showing respect and interest. Identifiers that Harb et al. (1993) used that were present for most cases in this study included class field trips, group problem solving, group projects, group experiments and subjective tests. Class discussion was an identifier used in all cases, which is relevant to note as it is considered an important way for students to improve their abilities to monitor and question their own thinking (NRC, 2005). One identifier (group discussion) was used in only a few cases (Liza and Michelle). All teachers spoke of students understanding the big picture to some extent, gaining a feeling of meaning and relevance, and the generating of enthusiasm.

Quadrant two focused on providing information, organizing and integrating new material, and providing time for thinking and reflection. Reflection time is a critical component to the learning process (Milner & Adams, 2015, Seaman & Rheingold, 2013, Skilton, 2011) and through the process of reflection the learner’s understanding is expanded (Smith & Knapp, 2011). As previously discussed, many teachers felt that they did not have time for reflection, while others mentioned that their reflection time for students consisted of open-ended test questions. A lack of student reflection time is a common problem and needs to be planned for and integrated into curriculum (Quinton & Smallbone, 2010). Others mentioned homework assignments which allowed the students the opportunity to reflect, but almost no teacher allowed for reflection time
in class. Lesson identifiers from quadrant two that were present in this study included demonstrations by the instructor, independent research, objective exams and gathering data. It is worth noting that a few identifiers from quadrant two were left out intentionally by teachers. Many teachers welcomed the opportunity to steer away from formal lecture and textbook reading assignments. While a heavily lecture-based curriculum is not advisable as it is considered to be a passive form of learning (Wurdinger & Carlson, 2010), it is a component of the quadrant that would benefit students of a particular learning style (Kolb, 1984), and should not be left out entirely.

Quadrant three objectives included that the teacher provide the opportunity for students to apply the material, help students to develop problem-solving patterns, and establish a safe learning environment. Examples from quadrant three that were done by teachers included homework problems, guided labs, field trips and laboratory tests. It has been found that problem-solving helps learners to develop self-directed learning skills (Schmidt, Loyens, Van Gog & Paas, 2007). Teaching students how to apply what they’ve learned is necessary for effective learning, and yet is often left out of teachers’ lessons since it is not required for standardized testing preparations (Thornburg, 2009). Although teachers included these aspects of the quadrant into their curriculum, it is not surprising that teachers did not speak specifically to providing opportunities for students to apply the material or for them to develop problem-solving patterns.

“There appears to be a huge chasm between how students like to learn and how teachers teach” (Wurdinger & Carlson, 2010, p. 2). Some teachers spoke to the lack of time they had, but students fare better when given the opportunity to spend time focused on a particular topic, rather than move along quickly to the next (Schwartz et al., 2009).
It seems that while the lesson examples provided by Harb et al. (1993) may work toward the listed objectives, they do not do so in and of themselves, and therefore it appears that many teachers were lacking in providing many of the necessary components for teaching to learners inclined to work best in quadrant three. This supports the claim by Wurdinger & Carlson that even teachers with the best intentions find it challenging to implement strategies that motivate and inspire their students (2010).

Finally with quadrant four, teacher objectives were to provide students with the opportunity for self-discovery, provide opportunities for students to share those discoveries, and to evaluate their performance. This quadrant appeared to be the most lacking amongst the teacher curriculum, as only one teacher spoke to allowing students the opportunity to discover answers to questions through self-discovery. Another teacher spoke to the fact that many of her students went on to focus on watershed-based topics for their science fair, but again, these are student-driven opportunities and not provided by the teacher, and therefore would not be included as a part of the teacher’s lessons. No teacher mentioned the opportunities for students to have their performance evaluated, although some students were tested at the end of their units. Examples of lessons from this quadrant that have been done by the teachers included field trips, open-ended problems, group discussion, and subjective exams.

It is worth noting that the objectives for quadrant four were found to be very valuable to teachers when they themselves were students in the watershed course. All teachers mentioned how much they enjoyed the opportunities they had in class to listen to the work done by other teachers, and some mentioned how the work of other teachers helped to shape their own class lessons. Strikingly, no teacher parlayed this personal excitement into something translatable to their own classrooms, and they did not incorporate this type of learning with their students. This
type of teaching in contrast to student learning and interest is not surprising to find, given that teachers often aim to teach in what they deem to be the most efficient manner (Wurdinger & Carlson, 2010). However, this is not the most effective way to teach or for students to learn, and it has been found to have detrimental effects. When students are presented with lessons that do not engage them, they often “check out” (Wurdinger & Carlson, 2010), and it has been proposed that this lack of interest due to passive methods of learning may be the reason why college baccalaureate completion is less than 50 percent (Astin & Oseguera, 2002). One study showed that 50 percent of high school dropouts chose to leave school because they were bored (Bridgeland, Dilulio & Morrison, 2006). Perhaps time constraints were a factor as mentioned by a few teachers in their lack of implementation, but it seemed that teachers lacked an awareness that this type of teaching would be of benefit to their students, and unfortunately did not work to provide these experiences for them. Representation of quadrant four was significantly lacking in the watershed curriculum of all teachers.

Harb et al. (1993) cautioned that “failure to traverse the full cycle is likely to produce deficiencies in the abilities of those whom we teach” (p. 71). Overall it is clear that the watershed course created change in the classrooms of its participants, and many significant changes were made to teaching style. However, teachers implemented some of the key elements of the learning cycle, but appeared to more heavily favor aspects of quadrants one and two over quadrants three and four. This may be due to time constraints but more likely seems due to a lack of awareness for its relevance.

**Student Connection Building (Through the examination of the Experiential Learning Model)**
The teachers in this study chose to implement the watershed curriculum into their classrooms in a manner that significantly differed from methodologies of their other units, and this seemed to indicate the reasoning behind why teachers felt their students could so strongly connect to the lessons. One example of this could be seen in the personal connections students made by the introduction of town history in Amy’s classes. Students moved beyond learning science content to understand how that content related to themselves and their families. Through giving context to help students understand content (Silberman, 2007), providing students with the opportunities to make personal connections to what they were learning (Beard & Wilson, 2006) and through inquiry-based classroom and field activities (Minstrell & Krauss, 2005), all of the teachers implemented their new curriculum in a manner that aligned well with aspects of the experiential learning theory. There is a direct need for and call to bring more experiential learning into schools (Wurdinger & Carlson, 2010) and therefore this finding is significant. In seeing a change to teaching that promotes a greater experiential learning opportunity for students, this study helps to indicate that when done properly, teachers can be given the tools necessary through professional development to overcome the current policies and practices by which so many teachers feel held back (Borko, 2004, Van den Bergh, 2014, Opfer & Peddler, 2011, Wurdinger & Carlson, 2010).

In making the lessons more personal, students were given the opportunity to internalize their lessons. As described by Beard & Wilson (2006), “perception and interaction are insufficient in themselves” (p. 21), as people are influenced by many things on a daily basis. It is through the understanding of personal relevance that people will selectively commit to learning and connecting with the subject or information at hand (Beard & Wilson, 2006). Teachers in this
study all commented that their students felt personally connected to what they had learned in their curriculum.

**The Apprehension-Comprehension Modes of Grasping Experience**

One must be cautious about making assumptions with regard to what students have internalized, and Kolb (1984) is clear in identifying that the experience itself is not enough. “The simple perception of experience is not sufficient for learning; something must be done with it” (p. 42). Students of the teachers in most cases in this study were given the opportunity to work with the topic for many days (in Sharon’s case, for the entirety of the school year). By coming back to the topic of the watershed in new ways over the course of many days and allowing students to process what they had learned by using that information, teachers were providing students with the opportunity to move through two distinct modes of grasping experience that Kolb defined as apprehension and comprehension (1984). These terms are defined further in the following section.

The experiential learning model moves through four distinct modes of learning (see figure 1.) but is divided into two distinct halves, which represent the grasping experience modes of apprehension and comprehension (Kolb, 1984). Kolb distinguishes between these two halves of the model by describing apprehension as a form of knowledge acquisition. Comprehension can best be understood as the means to understand this gained knowledge (1984). As an example, Kolb describes sitting in a chair as a form of apprehension, as one begins to know what the chair feels like while sitting in it, recognizing the location of the chair, etc. To further use this information through comprehension, one would then be able to describe the experience of sitting in the chair, remembering the location of the chair, remembering what the chair felt like, etc. (1984). In this way, one has obtained information and then used it to further understand their
experience. Each mode is necessary in the grasping of experience (1984) and thus, the learning process.

Many teachers reported what could be described as apprehensive and comprehensive experiences with their students. One example of this could be seen with the teachers that provided their students the opportunity to build a 3D model of a watershed. In doing this, they were able to provide students with the basic understanding of how a watershed works conceptually (apprehension), but then followed this with a field experience to demonstrate for them how that model worked in a real environment. The National Research Council specifically recommends the use of modeling as a means to help students further comprehend what they are learning (2005). It can be assumed that the students would have taken that concrete experience and knowledge that they gained from those experiences and been able to translate it conceptually to understand how their watershed works (comprehension). Teachers regularly provided students with opportunities to have these types of grasping experiences and they are critical to the learning process (Beard & Wilson, 2006, Smith & Knapp, 2011).

**Movement through the four modes of the experiential learning model**

In order for one to move from concrete experience to abstract conceptualization, Kolb spoke of the transformative experience that must happen through reflection. “Knowledge results from the combination of grasping experience and transforming it” (Kolb, 1984, p. 41). The transformative experience through reflection is crucial to deeper learning (Beard & Wilson, 2006, Kolb, 1984, Wurdinger & Carlson, 2010, Silberman, 2007), and there are a number of ways to promote the transformative process in a learning environment. For example, many formal programs incorporate the use of journal writing, writing papers or participating in discussion groups to promote reflection among students (Silberman, 2007). Unfortunately, in a traditional
classroom setting, teachers often feel they are prevented from activities which are outside of their regular schedule due to factors of assessment ability, control, time, student numbers and systemic problems (Allison and Wurdinger, 2005).

In the learning model there are two types of transformative experiences, and it seemed that while some of the teachers provided students with the opportunity for reflective observation, almost none of them provided an opportunity for students to move beyond abstract conceptualization to active experimentation. It is a common complaint among educators that they would like to enrich their teaching, but feel limited due to lack of resources and time (Johnson, 2006). Teachers would generally prefer to implement more active learning into their classrooms, but those that are required to implement state-mandated testing often resort to lecturing and abandon more creative methods of teaching (Wurdinger & Carlson, 2010). In this study two of the five teachers reported feeling limited in what they could do with their class time because of restrictions they felt due to state mandated tests.

A common complaint among teachers in this study was the time restrictions they felt, with regard to class period lengths, curriculum requirements, or standardized testing limitations. Because of these time issues, many teachers reported that they had wanted to provide opportunities for their students to be reflective, but simply couldn’t fit it in. Yet, this type of reflection is an essential part of the learning process (Quinton & Smallbone, 2010). Although active experimentation does not sound in and of itself reflective, it is the learning mode within the model that allows for the learner to take the step from conceptualizing what they have learned to actively using it (transforming it in an extensive manner) (Kolb, 1984). Interestingly enough, one teacher (Michelle) identified that her students desired to continue with their learning, and had not yet come to a place where they were content, as they still had many questions that
remained unanswered. Michelle provided her students the opportunity for active experimentation by allowing them to design their own lab experiments to examine the unanswered questions that had developed as a result of their unit, and by doing so, gave them the opportunity to access the four modes of the learning model. It is important to note that Michelle was a particularly confident teacher who had a “try it and see” mentality, and it may be that, like most teachers, those in this study may not have felt confident or comfortable in allowing for such an open interpretation of the transformation of knowledge by their students (Johnson, 2007).

Students of the teachers in this study were reported to have been able to more deeply connect with their learning than they might have otherwise with their traditional lessons. This is likely because the teachers provided students with the ability to understand the relevance to the lessons, offering meaning to the students, which initiated them to care and connect (Beard & Wilson, 2006, Chan, 2012). It is important for students to have the chance to comprehend why what they are learning matters (Dewey, 1938, Kolb, 1984), and in this case, the watershed units focused on bringing students into an awareness of their local surroundings. In doing this teachers were promoting place-based education as they felt they helped students gain a sense of appreciation and value for the connection between their classroom learning and the greater environment (Sobel, 2005). Also, by providing units that were student-focused rather than teacher-centered, students were able to feel a better sense of ownership over their learning, and therefore have a greater sense of investment (Chan, 2012, Estes, 2004).

While all the teachers felt that it was very important to provide students with a means to understand how their environment and watershed connected with them personally, some still felt stifled in their abilities to do this. This is a common complaint amongst teachers that feel as though they are limited for time, but this study showed that the teachers that felt most restricted
also felt a personal lack of confidence, which may have played a greater role in the lack of implementation of curriculum with greater purpose and understanding (Allison & Wurdinger 2005, Johnson, 2007, Louv, 2008, Wurdinger & Carlson, 2010).

Teachers in all cases found a way to make the information students were learning relate to themselves in some way, and in doing this, it was perceived by teachers that students felt a greater sense of investment and cared more about what they were learning as they could see how it directly related to them.

Kolb (1984) speaks to the importance of the transaction that occurs between the person and their environment in order for learning to take place (p. 34). With regard to providing life circumstances, Kolb identifies the importance of the environment, and essentially negates learning experiences that occur in the artificial environment. By providing students with a curriculum that is centered around the idea of the local environment and the human actions that can impact them, all teachers provided lessons which engaged the student in a “real world” educational experience, thus supporting the tenets of the experiential learning theory (Beard & Wilson, 2006, Hunt, 1981, Kolb, 1984, Wurdinger & Carlson, 2010). With regard to Liza who taught students about symbiosis and did not take students into the field nor focus on the local watershed, it is relevant to note that her lesson focused on environments that were not artificial, and therefore provided the opportunity to engage students through providing them with the real world relevance that Kolb stresses.

Teachers felt that in some cases students were able to find a sense of connectedness to a location related to their own personal experiences outside of the school. Although not necessarily done outside of their classrooms (such as in the case of the student who went on vacation, and through his course began to understand the human impacts to coral reefs at his vacation spot),
this type of connectedness is still relevant, valid and important. It demonstrates the building of the student’s valuation of that environment and continued connectedness (Sobel, 2005). This type of connectedness to a natural environment is lacking in children today and yet vital to their development (Louv, 2008, Sobel, 2005).

Overall it appears that due to the ways in which teachers were able to implement the Kolb model (1984), build excitement in their classes, relate the information on a personal level, and provide in-field learning experiences, students were perceived to have left feeling a greater sense of connectedness to their learning in the classroom.

**Long Term Impacts**

Through the style and content of the watershed professional development curriculum, participants in the course were able to more fully engage with the course’s goals and as a result, all teachers found that they had been impacted by their participation in the course in some way. This led to changes in student engagement, as teachers reported that they felt students had been personally impacted by the lessons in most cases.

The watershed course was designed with the intention to avoid and overcome many of the pitfalls of a typical professional development course, and worked with many different collaborators, including guest teacher lecturers, scientists, and course instructors in order to apply many different facets of knowledge. Teachers reported that learning from colleagues and others who had had similar classroom experiences to them during the watershed course had built their confidence. One of the features of successful professional development as identified by teacher participants is having a community of teachers with whom to work (Kazempour et al., 2014).
Because of the modeling that was done during the watershed course, which helped them to further understand content and activities, many teachers felt that they better understood how to apply what they had learned in their own classes. A second feature of successful professional development as identified by teacher participants (Kazempour et al., 2014) is gaining a sense of empowerment through modeling. Teaching through the use of modeling is a methodology that is promoted by the National Research Council to promote science learning in the classroom (2005), and the feeling of empowerment they gained stemmed from having lessons modeled rather than discussed, and therefore likely helped lead to the long-term changes that occurred as a result. Teachers may have also felt empowered, and therefore willing to create long-term change, because they felt a sense of understanding and comprehension for the relevance of the subject matter (Kazempour et al., 2014).

As many of the teachers changed their courses and content to implement the watershed curriculum, they also found that the ways in which they taught those classes had changed, and they found that their practices overall were being impacted. By taking the time to delve deeper on topics in order to provide an authentic learning experience, the watershed professional development course helped teachers in some cases to change the manner in which they looked at professional development, curriculum development, and methodology. Professional development, when done effectively, can have long lasting impacts for its participants (Borko, 2004) and can affect fundamental classroom change (Van den bergh, 2014).

One of the ways to affect positive change in the classroom is to provide teachers with the opportunities to participate in professional development that has relevance in their classroom and teaching experience (OECD, 2009, Van den Bergh, 2014, Opfer & Peddler, 2011). Teachers reported that they believed their students were impacted in a number of ways through their
participation in the watershed curriculum, and to varying degrees. According to teachers, students readily engaged with the lessons because they could personally connect to them. This feeling of connectedness likely stemmed from the ways in which the teachers themselves felt as a result of their participation in the watershed course. As the teachers demonstrated their own investment into the course and taught with confidence, it is likely that the students responded to this (Kazempour et al., 2014), and it is likely that students felt more confident in themselves with what they were learning as they interacted with their teachers on a different level.

**Recommendations for Future Research**

This study sought to examine ways in which teachers and their students benefitted from the teachers’ participation in an experiential education professional development course. One of the benefits of performing an interpretative phenomenological analysis is that first hand information is received and accounts are given directly from those that implemented the programs. However, in relying on personal accounts, this study was unable to objectively look at the teaching environment and was required to examine the classroom experience of students through the eyes of the teacher. As well, this study could only identify the activities of the class and field experiences through the perspective of the teacher. It would be more wholly encompassing to have an objective perspective on such experiences and therefore it is suggested that future research performed include observational study to be able to identify the manner in which courses were implemented.

It is clear from this study that teacher’s lessons were missing key pieces of the experiential learning model, and therefore missing an opportunity to teach in a manner that would accommodate all learners. At the same time some teachers in the study who could not implement the 3rd and 4th quadrants of the learning cycle found that their students had done so on
their own, through volunteering or participation in the school science fair. It may be that this study did not incorporate the necessary research to identify how students may be learning in the 3rd and 4th quadrants, and therefore it is recommended for future research that the student experience beyond the classroom be studied in an effort to more fully understand the students’ learning experiences with regard to the experiential learning model.

In seeking to understand greater long-term impacts that were made on teachers and their students, future studies may incorporate interviews with teachers over a much longer period of time to see how their watershed curriculum evolved and if it remained relevant over the length of many years. In doing so one may be able to more fully understand the greater impacts of experiential education professional development.

It is significant to note that the perspectives of the teachers were relied upon in gauging the student benefit of teacher participation, and therefore did not garner the experience of the student firsthand. In doing so, there may be many areas that were left unexamined with regard to the students’ experience in the classroom. It is the suggestion of this study that future research include direct contact with students through interviews or surveys in order to get a deeper understanding of how the implemented curriculum may have benefitted them.

Finally, an important aspect of this study that was discussed but not thoroughly examined was the manner in which the watershed course sought to overcome the barriers of implementation for professional development courses. Teachers spoke highly of the various ways in which the watershed course engaged them and led them to make changes in the classroom, and it would be valuable for future research to perform deeper analysis into how this course was prepared and what steps were taken to implement an experiential education professional development course such as this through the form of a program evaluation. It is also
recommended that future studies examine and compare this professional development beyond the realm of science education. In doing so, this program may be able to show what aspects of it align with the experiential learning model that may be of benefit beyond the science education arena.

Conclusion

Professional development courses are a part of life for a teacher and many seek programs and courses from which they can learn and benefit in their classrooms. In this study, it was found that teachers were motivated to participate in this science-focused experiential education professional development course, and due to the relevance of the information it provided, the effectiveness with which it was provided, and the reflection and collaboration it offered as a means for teachers to hone and implement their new curriculum, teachers found it to be of benefit to them. Teachers in most cases were able to build the connection between their students and their local environment through the implementation of place-based learning. Students that were taken out into the field for a portion of their watershed unit demonstrated an increased connection among those that were able to work more regularly in their outside learning environment, as measured by the teachers’ reports of engagement and long term impacts. Teachers indicated a high level of engagement from their students with the curriculum and methodology they implemented in the classroom from the professional development course and teachers found that the connections made by students during their educational experiences were impacted by their ability to find meaning and relevance from the course content within their own lives. Lastly, student connections were perceived to have been strengthened as a result of experiencing the area of study through place-based learning. Therefore, this study found that
students, along with their teachers, benefitted from their teachers’ participation in this professional development course.

Teachers incorporated some aspects of the experiential learning model (Kolb, 1984) which led to student engagement and long term impact, but the teachers were lacking in providing a wholly encompassing learning experience for their students by not providing enough opportunity for reflection and active experimentation. Students in most cases were not given the opportunities to learn in a manner that would align with the 3\textsuperscript{rd} and 4\textsuperscript{th} quadrants which provide students with opportunities to apply what they’d learned, and to share their new discoveries (Harb et al, 1993), but some students were able to meet these on their own through further personal studies and community engagement.

The present research has attempted to provide insight into the manner in which teachers further implement what they’ve learned from a professional development course into their real world classroom setting. What it has revealed is that, while it is often found that teachers do not incorporate professional development into their courses (Gulamhussein, 2013), if implemented properly, as this course has done, an experiential education professional development course for teachers can provide benefit to teachers and their students. This type of learning through experience is critical to education today (Louv, 2008, Wurdinger & Carlson, 2010), particularly as student interest in the sciences wanes and student performance decreases (OECD, 2014, Sladek, P., et al., 2010, Swarat et al., 2012). In providing teachers with effective professional development that is impactful and promotes science learning in the classroom, students may be provided with a more beneficial learning experience.

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NOTIFICATION OF IRB ACTION

Date: September 19, 2014  IRB #: CPS14-09-03
Principal Investigator(s): Leslie Hitch
Dana McNamee
Department: Doctor of Education Program
College of Professional Studies
Address: 20 Belvidere
Northeastern University
Title of Project: Participation in an Experiential Education Professional Development Course: An Analysis of the Teacher Experience
Participating Sites: Aquarium letter of permission in file
DHHS Review Category: Expedited #6, #7
Informed Consents: One (1) signed consent form
Monitoring Interval: 12 months

APPROVAL EXPIRATION DATE: SEPTEMBER 18, 2015

Investigator’s Responsibilities:
1. The informed consent form bearing the IRB approval stamp must be used when recruiting participants into the study.
2. The investigator must notify IRB immediately of unexpected adverse reactions, or new information that may alter our perception of the benefit-risk ratio.
3. Study procedures and files are subject to audit any time.
4. Any modifications of the protocol or the informed consent as the study progresses must be reviewed and approved by this committee prior to being instituted.
5. Continuing Review Approval for the proposal should be requested at least one month prior to the expiration date above.
6. This approval applies to the protection of human subjects only. It does not apply to any other university approvals that may be necessary.

C. Randall Colvin, Ph.D., Chair
Northeastern University Institutional Review Board

Nan C. Regina, Director
Human Subject Research Protection

Northeastern University FWA #4630
Appendix B – Recruitment Email

Dear XXXXX,

My name is Dana McNamee and I am a student researcher and doctoral candidate at Northeastern University. I am recruiting participants to contribute to a research study I am conducting titled "Participation in an Experiential Education Professional Development Course: An Analysis of the Teacher Experience". I am contacting you today because you have participated in the experiential education professional development course run through the education department at the New England Aquarium (you may more commonly know this program as the summer watershed course). This study seeks to understand how you and your students have benefitted from your participation, and your input is invaluable for providing such insight.

I am requesting your participation in a one-hour phone or in-person interview, and one follow-up conversation in which questions regarding your experience during and after course participation will be asked. There will be no risks involved, and should you have any concerns at any point or feel any perceived risks, you may remove yourself from the study at any time. Questions will be sent to you one week in advance of the interview for your review. This interview will remain confidential. I hope to be able to schedule interviews to take place by the end of October, but no later than December 2014.

Thank you very much for considering participation in this study. Please let me know if you have any further questions and I would be happy to answer them. In addition, please feel free to contact the Principal Investigator, Dr. Leslie Hitch by email at ********** or phone at ********** should you have any questions.

Sincerely,

Dana McNamee
Student Researcher and Doctoral Candidate, Northeastern University
Appendix C– Informed Consent

Northeastern University, College of Professional Studies, School of Education

Name Of Investigators: Principal Investigator--Leslie Hitch, Student Researcher--Dana McNamee

Title of Project: Participation in an Experiential Education Professional Development Course: An Analysis of the Teacher Experience

Informed Consent to Participate in a Research Study:

We are inviting you to take part in a research study. This form will tell you about the study, but the researcher may explain it to you first. You may ask this person any questions that you have. When you are ready to make a decision, you may tell the researcher via email if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement electronically.

Why am I being asked to take part in this research study?

You are being asked to take part in this research study because you have participated in an experiential education professional development course.

Why is this research study being done?

Professional development courses are offered to teachers as a means to improve the classroom experience for their students, but many professional development courses show no student improvement as a result of teacher participation. This research intends to analyze the teacher experience after participation in this experiential education professional development (EEPD) course and seeks to understand how and if the teachers and their students benefitted as a result of this participation.

What will I be asked to do?

If you decide to take part in this study, we will ask you to participate in a one-hour phone or in-person interview conducted by Dana McNamee, as well as one follow-up conversation approximately three weeks later. Questions will refer to your teaching practice after your participation in the experiential education professional development course at the New England Aquarium.

Will there be any risk or discomfort to me?

There are no foreseeable risks, harms, discomforts or inconveniences that you may experience through your participation in this study. Should you feel uncomfortable with participating you may discontinue the interview at any time.
Will I benefit by being in this research?

There will be no direct benefit to you for taking part in the study. However, the information learned from this study may help to inform similar programs in the future.

Who will see the information about me?

Your part in this study will remain confidential. Only the researchers on this study will see the information about you. No reports or publications will use information that can identify you in any way or any individual as being of this project.

Audio data and transcriptions will be used for completion of the dissertation, after which time data will be destroyed.

All data will be collected digitally and transferred to a password-protected computer after each interview. Data will be deleted from the original recording device. Only the researcher, Dana McNamee, has access to the password-protected computer. Interviews will not be discussed until the dissertation is complete. Signed consent forms will be stored in a locked safe in the researcher’s home for three years following the study.

Can I stop my participation in this study?

Your participation in this research is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the study, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, benefits, or services that you would otherwise have [as a student, employee, etc].

Who can I contact if I have questions or problems?

If you have any questions about this study, please feel free to contact Dana McNamee via email at ************** or phone: **********, the person mainly responsible for the research. You can also contact Leslie Hitch via email at ********** or phone: ********, the Principal Investigator.

Who can I contact about my rights as a participant?
If you have any questions about your rights in this research, you may contact Nan C. Regina, Director, Human Subject Research Protection, 960 Renaissance Park, Northeastern University, Boston, MA 02115. Tel: ***********, Email: *************** You may call anonymously if you wish.

**Will I be paid for my participation?**

No payment will be offered for your participation.

**Will it cost me anything to participate?**

No costs may be incurred due to your participation.

---

**I agree to take part in this research.**

____________________________________________                 __________________
Electronic signature of person agreeing to take part               Date

____________________________________________                 __________________
Printed name of person above (if signed by hand)                 Date

____________________________________________                 __________________
Signature of person who explained the study to the participant above and obtained consent.               Date

____________________________________________                 __________________
Printed name of person above (if signed by hand)                 Date
Appendix D– Interview Protocol

Interview questions:

1. Please provide me with some background information: Where do you teach? What grade(s) do you teach? How long have you been there? How long have you been teaching in general? Describe your school. Describe the student population with whom you work.

2. What prompted your participation in this course?

3. I’m familiar with the course and how it runs, the expectations for course completion and the requirements for student experiential education in connection to the course after you’ve finished. I would like for you to tell me what happened with your class(es) after your participation and how or if you implemented the watershed course into your classroom.

   a. How did the students respond to your lessons and curriculum? Can you give me examples of lessons?

   b. Were the students engaged during the experience? How do you know? Could you think of opportunities in the lesson(s) you did in which students were able to reflect upon what they did? If they had this opportunity for reflection, were they able to think about and apply what they did in a new context, and if so, could you provide examples where this occurred? Did the students have any continuation or extension of the lessons, which provided students the ability to experiment further based on what they’d done previously?

   c. Do you feel that your students benefitted from these lessons and curriculum? Why or why not? If so, in what ways did they benefit?

   d. Do you think these lessons had a long-lasting impact on the students? How can you tell?

   e. If they did not implement into the classroom: What prevented you from implementing the watershed curriculum into the classroom lessons?

   f. If they did not implement into the classroom: Do you envision implementation in the future? Why or why not?

   g. How is what you did in your classroom different than it would have been had you not participated in this course?

4. Do you feel your participation in this course has affected your teaching practice in general? In what ways? If it didn’t, what could have made it more impactful?
5. Do you see your participation in this course as having a long-lasting impact on your teaching? If so, in what ways?

6. Have you applied anything you learned in the watershed course to other units or lessons?

7. Is there anything that I haven’t asked?