PURA VIDA: TEACHER EXPERIENCES IN A SCIENCE EDUCATION STUDY ABROAD COURSE IN COSTA RICA

A Dissertation

by

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This dissertation meets the standards for scope and quality of
Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. This study is guided by two research questions: 1) what are the study abroad experiences that have influenced classroom teachers; and, 2) how do classroom teachers incorporate study abroad experiences into science curriculum planning and instruction in the classroom?

Participants were two in-service science teachers from schools located in the Southwestern United States. The participants were enrolled in the course, Environmental Science and Multicultural Experience for K – 8 Teachers offered through the Department of Educational Leadership, Curriculum and Instruction during their time as preservice teachers. The course included a two-week study abroad component in Costa Rica. Participants spent their mornings observing a monolingual, Spanish-speaking elementary classroom followed by a faculty-led multicultural seminar. Afternoons during the study abroad experience were dedicated to field science activities such as quantifying plant and animal biodiversity, constructing elevation profiles, determining nutrient storage in soil, and calculating river velocity. Throughout the course students participated in science-focused excursions.

A cross case study design was used to answer the two research questions guiding this dissertation study. Data collection included participant-created concept maps of the science experiences during the study abroad experience, in-depth interviews detailing the study abroad experience and classroom instruction, and participant reflective journal entries. Cross-case

analysis was employed to explore the uniqueness of each participant's experience and commonalities between the cases. Trustworthiness was established by utilizing multiple sources of data, member checking, documenting the process of identifying themes from findings, and peer de-briefing.

Four themes emerged via data analysis, they include: (1) experiencing science in Costa Rica, comprised of the categories of facilitated science experiences, collaborative grouping, and science stressors; (2) studying abroad in Costa Rica, containing the categories Costa Rica is your oyster, background of Costa Rica, foreground of Costa Rica, atmosphere of Costa Rica, and Costa Rican culture; (3) transferability of science experiences including the categories disposition of teaching, pedagogical knowledge, what you teach, and for whom you teach; and (4) the multicultural classroom made up of the categories Costa Rican classroom struggles, positive Costa Rican classroom climate, transferability of instructional approaches, and developing cultural competency.

Implications for study abroad decision-makers and stakeholders are included. Additionally, recommendations for future research are also described. Preservice science teachers develop their knowledge of science, confidence to teach science, and ability to instruct students in the field of science in a multicultural classroom, as a product of science-focused study abroad opportunities.

DEDICATION

This dissertation is dedicated to Mr. and Mrs. William “Bill” Soltis for bringing their vision of the research center in Costa Rica to life--creating a center which provides students with superb study abroad experiences in Costa Rica, while also conserving the wealth of resources that Costa Rica has to offer—pura vida!

“Traveling—it leaves you speechless then turns you into a storyteller.” –Ibn Battuta. Here are our stories.

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Last, but not least, I would like to thank my goddaughter, Paloma, for the inspiration to create the best classroom for her future.

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CHAPTER 1: INTRODUCTION

In May of 2012, twelve undergraduate and graduate students, and three faculty members traveled to Costa Rica for a two-week science-focused study abroad experience. As the graduate assistant on this trip, I was a part of the day-to-day science experiences and growth of individual participants.

I had been teaching six years, but I was not in the classroom at the time of the study abroad course. My teaching experience had been in the high school biology classroom. I was one semester into my doctoral program and a graduate research assistant with the College of Education at my university, working for a grant that prepared college science faculty to teach preservice science teachers. This study abroad course was my first time traveling and studying abroad.

My reason for studying abroad, in large part, came from encouragement from my supervisor at the time. Not only had she traveled to Costa Rica before, but she also stayed at the researcher center where the study abroad course was housed. The research center where we stayed in Costa Rica was established by a university alumnus. The purpose of the center was to create a site where students could conduct research in the rainforest, and participate in college courses and service learning opportunities while abroad. Most importantly, the research center provided the physical site and additional resources to faculty and students who stayed at the research center. The research center includes a large multi-purpose building which includes labs, classroom, offices, and a dining hall. The main building is situated downhill from eight modern bungalows where travelers stay during their sojourns. The entire campus is surrounded by sprawling rainforest, is Wi-Fi enabled and Americans with Disabilities Act (ADA) compliant. During her time at the research center as a student, my supervisor played a role in characterizing

the terrain as the center was being built. Traveling abroad had always been something I had a desire to do, but the means and the opportunity were never aligned. Studying abroad was, for lack of a better word, foreign to me, but I felt comfortable traveling with my supervisor because of her experience.

Studying abroad affected me in a way that no other experience as a graduate student had. Experiencing Costa Rica, its people, and its culture was a reality check. The people of Costa Rica had a rich community of support and enthusiasm for life—perhaps, something I was missing. During the study abroad course, the field science activities where a major motivator for me to return to the classroom—I felt the activities had a role to play in the K – 12 science classroom. The two weeks I spent in Costa Rica helped me realize that I wanted to spend more time there; and so, I moved traveling abroad to the top of my list with completing my doctoral degree. My experiences abroad, my desire to complete my doctoral degree, and where I was in my career, came together to form my research interest in this study.

While the number of students studying abroad has increased over the last 20-years, efforts are underway to increase that number (Lewin, 2010). A major challenge to increasing study abroad feasibility is cost. Despite this challenge, study abroad decision makers aim to increase the number of students studying abroad.

A daily part of this study abroad experience was the critical reflection through journaling. Critical reflection serves a student when it is included in faculty-led study abroad courses (Roholt & Fisher, 2013). Critical reflection may be beneficial to students who find it difficult to describe the changes in their cultural competencies (Anderson & Lawton, 2011). Critical reflection is a contributing factor to developing cultural competency for preservice and in-service teachers while participating in study abroad programs, and by extension developing instructional

practices that will be used to teach students from other cultures (Sharma, Phillion, & Malewski, 2011).

Today's economy relies heavily on science—so much so, individuals who drive the economy must be science-savvy citizens who are informed to make decisions impacting their lives and the lives of the members of their communities. As a result, there is a demand for improved science education (Liu, 2009). The students in our country perform poorly in science compared to other countries including China, Singapore, Japan, and Finland (Froese-Germain & Canadian Teachers, 2013). Today's classrooms are dominated by scripted lessons and standardized tests. However, students benefit from lessons that encourage them to think critically about science—fostering deep understanding of science through their school years (Songer, Kelcey, & Gotwals, 2009). To relay the importance of a deep understanding of science, teachers must also have a deep understanding of science.

For science teachers, spending a greater time engaged in preparation for time in the classroom is advantageous. During this time of professional development, in-service science teachers may develop a stronger grasp of instructional practices for the science classroom (Goodnough & Hung, 2009). A teacher's understanding of best practices for the science classroom benefits students as well.

A closer examination of teacher education courses allows for exploration of experiences of a preservice teacher. During teacher education courses, preservice teachers have the opportunity to interact with PK-12 students even though the preservice teachers are still learners themselves. This early exposure to the classroom environment is especially beneficial to preservice teachers because it offers the opportunity to be mentored by in-service teachers with

well-developed science knowledge, skills, and instructional methods (Patterson, 2011). This type of collaboration supports the idea learning is a social and an interactive process.

Not all teacher education programs are comprehensive or interactive by nature. Individuals who prepare to become teachers must be prepared to enroll in science courses to acquire science content knowledge and science methods courses to acquire effective instructional science teaching methods. Science content knowledge includes disciplinary facts and concepts described in science curricula and instructional materials—science content knowledge should be deep to facilitate understanding (Luft, Dubois, Nixon, & Campbell, 2015). However, new science teachers enter the classroom with limited content knowledge; furthermore, understanding *how* content knowledge is constructed is also pertinent for science instruction (Luft, Nixon, Dubois, & Campbell, 2014).

Preservice teachers learn when instruction is constructivist in nature—when learning is active; however, teacher education and content courses lack constructivist instructional methods (Thompson, Windschitl, & Braaten, 2013). Constructivism, or *learning by doing*, is a method which, if used in the college classroom, can transfer to a preservice teacher's future classroom. Student teaching, internship, or practicum—the significant culminating course for preservice teachers, is especially important because it cements theory into practice as preservice teachers transition from the university classroom to the science classroom (DeVillar & Jiang, 2012).

Depending on the nature of the course, field experiences vary in their scope of objectives. Field experience courses are not only utilized to reinforce the concept experience is social as preservice teachers interact with faculty members; but, to also learn through experience—where classroom information and theory meets real-world practice (Fletcher & Luft, 2011). As preservice teachers participate in field experiences they are able to observe instructional practices

in action. Field experiences are also an occasion for preservice teachers to foster science content knowledge as exposure to science is increased with regular visits to the field (Bhattacharyya, Volk, & Lumpe, 2009).

Because of the nature of college and university schedules, teacher education courses—including field-based courses—are usually a semester in length. However, the need for preservice teachers to develop their own science content knowledge can be achieved by working with the broader school community over a longer period of time (Harrington & Enochs, 2009; Sadler, 2006). A deeper exposure to science teaching and learning with more individuals with developed skills in both of these areas is a valuable experience for preservice teachers; yet, longer time in the field and mentorship by experienced teachers are not the only vital components to field experiences during teacher education courses.

As preservice teachers observe science content delivered through effective instructional practices during field experiences, learning becomes meaningful. Regardless of the type of field experience a preservice teacher participates in, the field experience should safeguard adult and child learning—the preservice teacher and the student (Harrington & Enochs, 2009). Inquiry-based field experiences encourage science learning by *doing* science as opposed to listening to lectures and observing demonstrations (Bhattacharyya et al., 2009). Professional development partnerships occur when cohorts of preservice teachers visit the same site for field experiences (Saxman, Gupta, & Steinberg, 2010). Family Science Nights also offer preservice teachers the opportunity to interact with students *and* parents as a type of field experience—a crucial element of teacher preparation (C. McCollough & Ramirez, 2012; R. B. McDonald, 1997). Other types of field experiences include observations, tutoring, assisting, and teaching, in and out of science classrooms during early teacher education courses (Capraro, Capraro, & Helfeldt, 2010).

Participating in field experiences during teacher education gives preservice science teachers the chance to engage in real-world practice that encourages authentic science experiences, which will support their teaching efforts when they are in a classroom of their own.

Advances in authentic learning occur when preservice teachers have the opportunity to develop and execute science lesson plans for students using the same conventions as in-service teachers (Hanuscin & Musikul, 2007). Additionally, Hanuscin's and Musikal's (2007) research has found summer field experiences are especially beneficial to preservice teachers because summer field experiences meet regular field experience requirements while *also* encouraging preservice teacher autonomy—due to the absence the regular school year's scripted lessons and pressure to yield to standardized testing. Options for other field experiences—including, and especially, those in summer—warrants exploration to encourage preservice teacher experiences in science curriculum planning and instruction.

Yet, not all field experiences occur in the classroom. There are field experience opportunities awaiting preservice teachers at science museums and nature centers (Worsham, Friedrichsen, Soucie, Barnett, & Akiba, 2014). Experiences at science museums and nature centers qualify as field experiences even though preservice teachers are *outside* their comfort zones. Other science experiences include pursuing science-related clubs and hobbies, citizen science or community education programs, and exhibits (Liu, 2009). During the summer or on the weekend, visits to beaches and national parks are considered sites of science education, as well as zoos and aquariums (Worsham et al., 2014). For example, in a study of authentic scientific inquiry, framed by the 5E inquiry-based learning cycle, preservice teachers came together with in-service teachers and higher education faculty to implement a lesson for elementary school students about human impact on marine ecosystems and blue crabs using

knowledge from a summer research experience (Jeffery, McCollough, & Moore, 2016). Print and electronic media, and visits to libraries also serve as resources of science experience (Liu, 2009; Worsham et al., 2014). By the same comparison, study abroad also qualifies as a science field experience which occurs outside of the home classroom for preservice teachers (Jefferies & Nguyen, 2014). In science education, study abroad allows the student the opportunity to explore locales specific to ecological study because this type of study requires hands-on learning (Norris, 2016). By providing study abroad as an opportunity for experiential learning, student travelers are better able to prepare themselves for teaching science.

One sub-population of diverse learners in the science classroom requiring additional instructional support includes individuals who are English language learners (ELLs). English Language Learners (ELLs) have background knowledge to bring to the science classroom. Student background knowledge plays an important role in building new science content (Bautista & Castaneda, 2011). Another benefit of study abroad participation by preservice teachers includes access to other cultures—including those with speakers of other languages and members of other cultures—and, furthermore, fostering cultural competency (Blair, 2011). Cultural competency is not a concept restricted to the arena of public education. Cultural competency is a positive attribute sought out in most fields of professionalism. Developing cultural competency—the ability to recognize differences in individuals of other backgrounds—is a product of learning transformation, specifically a shift in world view can be provided by participating in study abroad (Graham & Crawford, 2012). Study abroad experiences initiate the shift in world view required for preservice teachers to develop cultural competency (Colville-Hall, Adamowicz-Hariasz, Sidorova, & Engelking, 2011; Fine & McNamara, 2011; Marx, 2008).

Statement of Problem

Study abroad programs are one approach to field experiences to encourage preservice teacher development. Like Hanuscin and Musikal (2007), Blair (2011) expresses study abroad is another route by which preservice teachers can achieve authentic learning whereby experiences reinforce lessons from course content. For in-service teachers, acquiring science content knowledge is not the only requirement to become a teacher. Preparation in instructional methods for diverse learners requiring additional support by the teacher is also a prerequisite (DeVillar & Jiang, 2012).

Purpose of the Study

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. Qualitative inquiry is useful for exploring situational experiences through data analysis (Creswell & Poth, 2017; Denzin & Lincoln, 2011). This study explored a time when participants were situated in Costa Rica during their study abroad experience. I analyzed concept maps, interview transcripts, and reflective journal entries to construct meaning participants made from their study abroad experiences.

Research Questions

This study is guided by two research questions: 1) what are the study abroad experiences that have influenced classroom teachers; and, 2) how do classroom teachers incorporate study abroad experiences into science curriculum planning and instruction in the classroom?

Significance of the Study

A gap in the literature exists for exploring science-focused study abroad experiences for preservice teachers (Farris, 2012; Lalley, 2009). Thus, the impetus for this study is to provide understanding of the potential benefits of science-focused study abroad experiences for preservice teachers during their teacher education studies. It is also the aim of this study to inform higher education decision makers who facilitate planning, implementation, and evaluation of well-designed study abroad experiences for teacher education students.

One area of study abroad research which warrants further exploration is the effects of study abroad on academic and intellectual development (Farris, 2012). Additionally, the processes of learning in study abroad are not fully understood. This especially includes examination of learning processes via qualitative inquiry to investigate experiences and meanings of experiences resulting from study abroad (Lalley, 2009). Moreover, in the realm of teacher education, there is a need for change in subject matter preparation—more than requiring a minor in a discipline or more subject matter coursework (Corcoran, 2009).

The findings of this study contributed to the growing body of knowledge of study abroad in higher education, including, and especially, as it supports science education. Implications of this study have been directed to study abroad decision makers in higher education. Participating in study abroad abounds with benefits in addition to developing science confidence and cultural competency (Kernaghan, 2012; Marx, 2008). Other benefits of study abroad involve increasing knowledge, personal and professional development, and improved teaching methodologies (Biraimah & Jotia, 2013).

Population and Sample

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. Participants included classroom teachers who participated in the course Environmental Science and Multicultural Experience for K – 8 Teachers. Environmental Science and Multicultural Experience for K – 8 Teachers was a stacked course, a course offered concurrently to undergraduate and graduate students. Including undergraduate and graduate students, twelve students completed the study abroad course; however, only nine of the students were eligible to participate according to inclusion criteria. The course was offered through the Department of Educational Leadership, Curriculum and Instruction at a university in the Southwestern United States. The course was offered during a two-week mini-semester occurring between the traditional spring and summer semesters. Participation in this study was voluntary and confidential.

Context

The setting for the course, Environmental Science and Multicultural Experience for K – 8 Teachers was a research and education center in Southeastern Costa Rica, located in primary and secondary growth rainforest. The center's facilities include dormitories, laboratories, classrooms, computer lab, offices, a video conference room, and a cafeteria. The entire campus is handicap-accessible and Wi-Fi enabled. Opportunities for engagement at the center include research, education, and community service/service learning. The center is available for use by universities in and out of the university system. The location of the center is conducive to area

cultural and recreational activities. Student activities and excursions from this particular study abroad experience are detailed in Chapter 3.

Methodological Framework

In an effort to answer my research questions, this study followed a qualitative framework. Qualitative inquiry seeks to understand the meaning made by an individual (Glesne, 2011). Qualitative research allows for deep exploration of an experience in order to develop a robust description of the experience (Denzin & Lincoln, 2011). In the same vein, I hoped to understand the experiences preservice teachers had while participating in a study abroad course.

This dissertation study followed a cross case study design, where each participant comprised their own case, with the goal of developing a robust description of the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers. The purpose of case study research was to acquire an in-depth understanding of a social situation and the meanings made by those individuals involved (Merriam, 1998). With each participant as the subject of their own case, I was able to explore the nuances of each participant's experience and also compared the cases to reveal similarities among the cases. Through this constructivist lens, the study abroad experiences were organized in a way that allowed for organization which encouraged the realization of meanings made by participants (Lincoln & Guba, 2013).

During the 14-days abroad in Costa Rica, the participants had spent time in the Costa Rican grade school observing teacher and student interactions, and in the neighboring rainforest completing field science activities. After each observation and science activity, students and faculty debriefed at the center's classroom. Time outside of class hours were spent touring Costa Rica for academic and cultural experiences. All activities were coordinated by the faculty of the course and the staff at the center, and were attended by the students and the researcher. To

describe these experiences, I asked the participants to create concept maps to frame the study abroad course (Greene, Lubin, Slater, & Walden, 2013). Concept maps were useful for allowing individuals to convey their understandings about the study abroad course (Sellmann, Liefländer, & Bogner, 2015). Concept maps were not only useful for describing the study abroad experience, but science experiences during study abroad as well (Safdar, Hussain, Shah, & Rifat, 2012). Participants received verbal instructions about how to construct concept maps, along with an example concept map, before they were asked to construct their own (Greene et al., 2013; Wheeldon & Faubert, 2009). For the purpose of this study, concept maps illustrated participant science experiences as a result of the study abroad—the first step in Kolb's Experiential Learning Theory (Kolb, 1984). After concept map construction, in-depth interviews were required to gain an understanding of participant experiences during study abroad and applications of these experiences in science curriculum and instruction (Gieser, 2015). Additionally, participants were able to comment on any gains in self-confidence as a result of the study abroad experience. Questions based on the interactions of the participants during the study abroad experience were developed before meeting with participants; however, interviews were semi-structured—some questions were added, modified, or even omitted (Glesne, 2011). Last, participants provided field journals from their study abroad experiences. Journal entries from field journals enabled participants to activate the second phase of Kolb's Experiential Learning Theory—reflection (Kolb, 1984).

Concept maps were qualitatively examined based on the development of the concept maps by participants (Kinchin, Hay, & Adams, 2000). Interviews were transcribed and underwent two rounds of coding to identify themes from the experiences of the participants (Saldaña, 2009). Field journals were processed via content analysis to identify codes, form

categories, and develop themes contributing to the construction of the essence of the participants' experiences (Glesne, 2011; Yu, 2008). Interview transcripts, reflective journal entries, and concept map reflections, which were processed via content analysis, underwent two cycles of coding. Salient excerpts of text from the aforementioned data sources were each summarized into a short, descriptive phrases to comprise the codes. Phrases, or codes, were recorded on index cards. Index cards were manually sorted into groups based on similarities to form categories. Categories containing similarly coded phrases were manually lumped together accordingly to construct encompassing themes (Saldaña, 2009).

Before data collection could commence, permission from the university's Institutional Review Board (IRB) was required. After permission to conduct research was granted, during recruitment, participants were assured their participation was voluntary and confidential, and they were able to withdraw from the study at any time. I received informed consent from each of the participants. I operated under the assumption that the participants willingly attended the study abroad experience and participated in the activities and excursions. Additionally, the participants were impacted by their study abroad experiences. I strongly believe the science activities and excursions provided opportunities for authentic experience and have applications in the K – 12 science classroom.

Theoretical Framework

Due to the nature of study abroad—a learning environment that provides personal and career development opportunities—experiential learning will guide the direction of this study. Study abroad affords the participant an experience to reflect on and opportunities for creating new ideas to put into play in the grade school classroom (Kolb, 1984). The focus of this study was the exploration of the science-focused study abroad experiences of classroom teachers who

studied abroad as preservice teachers during their time spent in higher education, specifically in teacher education courses. Study abroad courses have the potential to shift perceptions through authentic experiences, and even more so when course leaders are familiar with experiential learning (Roholt & Fisher, 2013).

Additionally, self-confidence is a visualization of the total self as a result of successes and failures (Bandura, 1982). Self-confidence traverses both thoughts and actions. Self-confidence mediates reactions to stressors and dependence on others to produce achievements in one's career (Bandura, 1982). Study abroad has an impact on career development and effects self-confidence (Farris, 2012).

Definitions

For the purpose of this study, the following terms will be described as such.

Assertion – a finding about the study (Stake, 2006)

Case – A person, group, or situation explored in a study (Merriam, 1998; Stake, 2006; Yin, 2013)

Cross Case Analysis – Comparing and contrasting cases to produce new information (Yin, 2011)

Curriculum – The plan for opportunities and experiences in a course of study students have while supervised by teachers at school (Pinar, 2012)

Faculty-led Study Abroad – A college study abroad course instructed by a faculty member at the aforementioned college (Graham & Crawford, 2012).

Finding – upholds certain activities of the cases (Stake, 2006)

In-service Science Teacher – A certified classroom teacher who teaches science as part of a self-contained or departmentalized classroom (Clark, Byrnes, & Sudweeks, 2015)

Preservice Teacher – A student enrolled in teacher education courses during a time before the individual becomes certified to teach and is employed as an in-service teacher (Clark et al., 2015)

Science Content Knowledge – A teacher's knowledge of science (Maerten-Rivera, Huggins-Manley, Adamson, Lee, & Llosa, 2015)

Short-term Study Abroad – A college course taken for credit involving a study abroad component which lasts two to three weeks (Conner, 2013)

Stacked Course – One course which serves both undergraduate and graduate students concurrently

Theme – upholds the dissertation research questions (Stake, 2006)

Chapter Summary

This chapter presented a summary of the dissertation study. The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. A review of scholarly literature suggests study abroad experiences influence how knowledge is constructed and increases content knowledge (Vatalaro, Szente, & Levin, 2015). Qualitative research methods were utilized to generate a deep description of the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers.

This dissertation will follow a traditional outline and will continue with Chapter 2, a review of scholarly literature of science teacher education, study abroad, study abroad in education, and teaching efficacy. Chapter 3 describes the study's design, including the methodological framework applied to answer this study's research questions. Chapter 4 will

present the findings of qualitative analyses of students' study abroad experiences. Chapter 5 will summarize findings, communicate conclusions, and identify best practices for study abroad decision makers in higher education who plan, implement, and evaluate high-quality, science-focused study abroad experiences for preservice science teachers.

CHAPTER 2: REVIEW OF LITERATURE

Chapter one of this study, introduced the option of study abroad as a field experience for education students during teacher preparation. Study abroad is a means for providing science experiences to university students, specifically preservice teachers. Opportunities to teach abroad for education students helps develop instructional strategies and materials, gives the opportunity to apply knowledge acquired in the university classroom, and utilize culturally responsive instructional strategies (DeVillar & Jiang, 2012). Additionally during study abroad experiences, preservice teachers have the ability to practice learner-centered instructional strategies, contribute to advanced curriculum planning, experience a relaxed classroom environment, and observe the school's role in the community (Flannery-Quinn, Morton, & Brindley, 2011). Experiences studying abroad for teacher education students, brings about the realization of critical awareness, or the role government plays in school operations (Menard-Warwick & Palmer, 2012). The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. This study is guided by two research questions: 1) what are the study abroad experiences that have influenced classroom teachers; and, 2) how do classroom teachers incorporate study abroad experiences into science curriculum planning and instruction in the classroom?

Theoretical Framework

Experiential Learning

This study is grounded in Experiential Learning Theory. Experiential Learning Theory focuses on *how* individuals make meaning and extend his or her learning through lived

experiences (Kolb, 1984). Kolb (1984) describes four stages to Experiential Learning Theory which include: 1) Concrete Experience; 2) Reflective Observation; 3) Abstract Conceptualization; and 4) Active Experimentation. The learning process, according to Experiential Learning Theory, begins with living an experience. During the second stage of Experiential Learning Theory, Reflective Observation, the individual thinks about what has happened during the time the experience transpired. During the critical third stage, Abstract Conceptualization, the individual evaluates the role the experience will play in influencing the formation of new meaning and, by extension, new learning. In the last stage of Experiential Learning Theory, Active Experimentation, the learner attempts to apply the new meaning under new conditions to test if the new meaning provides perspective into another subject matter (Kolb, 1984).

Experiential Learning Theory posits students acquire new knowledge through experiences and observations illicit conflict in understanding, motivating the student to re-evaluate current understandings, or misconceptions, to create new understanding (Jefferies & Nguyen, 2014). The stages of learning via experiential learning include: 1) experience; 2) reflection; 3) conceptualization; and 4) application (Kolb, 1984). The result of experiential learning is student ability to draw conclusions about how beliefs and norms are intertwined (Wynveen, Kyle, & Tarrant, 2012). Additionally, students reflect—during the second stage of experiential learning, on their experiences—stage one, to provide insight—stage four, supplements course content (Kolb, 1984; Roholt & Fisher, 2013). Individuals communicate their experiences by story-telling in small groups or by facilitated discussion in large groups (Jefferies & Nguyen, 2014)—a goal of this study—important for communicating the benefits of study abroad.

Study abroad offers the means to the end of achieving experiential learning. Experiential learning can occur in intellectual development, cross cultural and global awareness, civic and social responsibility, ethical development, career exploration, and personal growth (McClellan & Hyle, 2012). Many of these occurrences can be delivered via study abroad. While many university classes are formal, lecture-based, and lack hands-on activities, university classes outside the university include field research, service learning, volunteering, and internships—these opportunities are more active routes to learning (Blair, 2011; Brewer, 2011; Jefferies & Nguyen, 2014). These types of experiences are incorporated into study abroad programs (Figure 1).

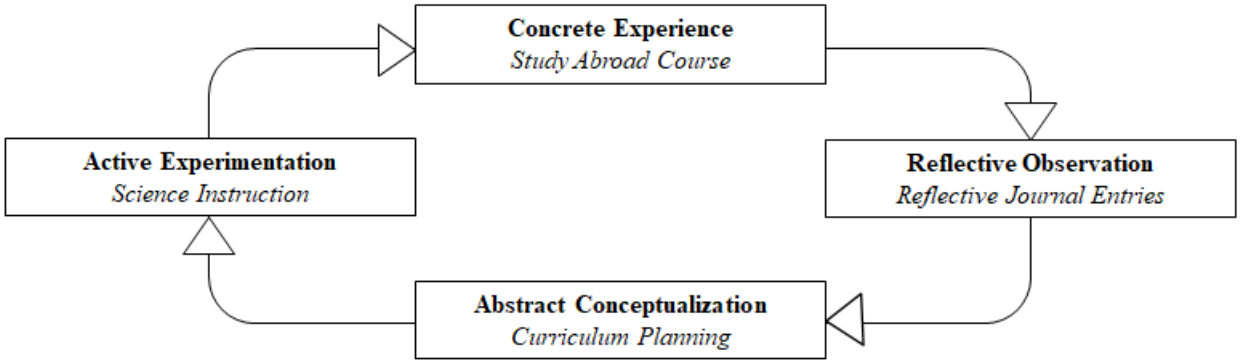

Figure 1. Kolb's Experiential Learning theory as it relates to this study

Experiential learning is supported by study abroad (Roholt & Fisher, 2013). This is especially beneficial because many countries across the world offer various environments to study abroad (Gristwood & Woolf, 2011). Experiential learning in study abroad creates learning that is more potent, as experiences occur in foreign environments, outside the classroom, and in different cultures (Blair, 2011; Roholt & Fisher, 2013; Wynveen et al., 2012).

In a study of 210 early-childhood, primary, and secondary teacher education students, researchers examined student understanding of cultural awareness. Researchers designed a cross-case analysis of three case studies. Students in case study one completed an on-campus

multicultural education course. Students in case studies two and three completed a study abroad course where preservice teachers taught students from different cultures than their own. Experiential Learning Theory framed this study because the course objectives for these students encompassed the idea that the students would be emerged in situations which would provide learning experiences relevant to their studies in teacher education. Findings from cross case analysis showed students were prepared to understand and respect people from different cultural backgrounds as a result of course completion (Northcote, Kilgour, Reynaud, & Fitzsimmons, 2014).

One form of experiential learning is impromptu learning. Impromptu learning is a type of instantaneous learning that happens during a transformative learning experience including, and especially, study abroad. An event which triggers impromptu learning has to be significant enough to produce a shift in a learner's thinking. A disorienting event during study abroad would be one avenue to achieve impromptu learning. Study abroad experiences are riddled with disorienting events due to the nature of study abroad including being in another country with, often, speakers of another language. Study abroad students in Puerto Rico provided data in the form of interviews and journal entries to allow researchers to characterize impromptu as experiential learning. Being able to describe impromptu learning benefits study abroad planning and implementation (Jefferies & Nguyen, 2014).

Ultimately Experiential Learning Theory fits the framework of this study, and moreover the purpose of the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers. The travel component of the course provides the context of the first stage of the theory, experience. When participants were abroad and were completing the daily reflective journal entries, they achieved the second stage of the theory, reflection. As teachers apply what

they have learned while studying abroad during curriculum planning, they achieve the third stage of the theory, conceptualization. Finally, as teachers implement curriculum influenced by their study abroad experiences in their science classrooms they achieve the last stage of Experiential Learning Theory, experimentation.

Self-Efficacy

Self-efficacy is a prediction of the future-self as it relates to both successes and failures (Bandura, 1982). Self-efficacy influences an individual's thoughts, actions, and emotions. In a study of effects of self-efficacy, the more advanced an individual's self-efficacy is the more improved the individual's performance and, the more diminished the individual's emotional expression (Bandura, 1982).

Self-efficacy explains changes in coping mechanisms, reactions to stressors, obstinate behaviors, giving in to failure, dependence on others, the illusion of self-efficacy, achievement, interest, and career interests (Bandura, 1982). In a study of 369 Penn State University undergrads, study abroad was measured as an effect on career self-efficacy. During the 2007 – 2008 school year, the researcher implemented the Career Decision Self-Efficacy Scale (CDSE-SF) as a pretest and posttest at the beginning and end, respectively, of study abroad experiences. Study abroad had a statistically significant effect on career development; and, moreover, study abroad highly impacted interest in international travel (Farris, 2012).

Outside factors have the potential to influence self-efficacy as well. In a study of 619 preservice science teachers from four universities in Turkey, researchers investigated factors influencing academic success as a predictor of self-confidence. Academic success was attributed to academic expectations from universities and lessons preservice science teachers received (Uluçinar Sagir, Aslan, Bertiz, & Öner Armagan, 2016).

Bergman and Morphew (2015) evaluated the success of a new science content course designed specifically for elementary preservice science teachers. Participants included 154-students. Data analysis showed positive relationships between completion of the course and teacher beliefs toward science. Implications for science education include designing courses for this specific audience, elementary preservice science teachers, and a need for collaboration between education and science faculty (Bergman & Morphew, 2015).

The need for courses designed specifically for preservice science teachers is especially important because not all preservice teachers have had positive science experiences. 'Lisa,' one case from a larger multiple case study, is one example of such a student—negative attitude toward science due to negative science experiences and decreased self-confidence. Lisa enrolled in a science methods course during her time in teacher education at her university. As a result of Lisa's experience in the science methods course, her attitude toward science teaching and learning improved, and by extension so did her confidence for teaching science (Kazempour, 2014). Although Lisa's attitude toward science and science self-confidence improved, not all preservice science teachers experience the same confidence in teaching science. In a study of 188 elementary preservice science teachers, teachers held positive attitudes toward the natural sciences as opposed to the physical sciences, for which they held negative attitudes (Brigido, Borrachero, Bermejo, & Mellado, 2013). Perhaps this is an opportunity to design a course, not only for preservice science teachers, but for preservice science teachers in the physical sciences.

Thirty elementary preservice science teachers enrolled in a field-based science methods course. Students were stationed at a campus where they completed their coursework and practiced teaching—making their experience constructivist in nature. Students worked with fifth-grade students for a five-week period near the end of the semester. The preservice teachers

were tasked with creating innovative curriculum as part of their coursework. Data analysis revealed teachers reported increases in science confidence (Flores, 2015).

Study abroad also has the potential to positively influence self-confidence. In one short-term and one long-term study abroad experience in France and Spain, 39 foreign language learners enrolled in course to acquire new language skills. Researchers investigated language acquisition at the beginning of a course and at the end of the course. Study abroad showed to significantly affect self-confidence in language acquisition in participants—regardless of length of study abroad experience. Participants explained high levels of interactions with the host countries showed higher levels of self-confidence (Brigido et al., 2013).

Study abroad not only positively influences career self-confidence and self-confidence in language acquisition skills; but, study abroad also encourages cultural competency. A developed cultural competency is especially beneficial for classroom teachers who teach diverse learners—learners from different cultures, socioeconomic statuses, and those with special needs. Cultural competency is associated with teacher self-confidence as teachers are able to provide equitable science teaching. Cultural competency becomes especially developed when field experiences, or study abroad, include a community based service learning component (Flores, 2015).

Science Teacher Education

In national comparisons, the gap between high-achieving countries and low-performing countries has opened the door to discuss ideas, practices, and approaches in teaching science (National Science Teachers Association, 2009). The accountability lies in the academic achievement of students (Genç, 2015). It is the responsibility of the classroom teacher to educate the students of her classroom in science. Additionally, the goal of public education is to provide an in-depth understanding of science concepts to grade school children. Students must possess a

set of skills, attitudes, values, and knowledge, which aid in critical thinking, problem solving, and decision making (Genç, 2015). Moreover, science learning continues to develop during one's lifetime.

As advancements in science, technology, engineering, and math (STEM) fields continue to prosper, there will be a continuous call for improvement in public grade schools (Liu, 2009). In order to make in improvements in schools, schools must equip themselves with effective teachers. In order to produce an effective teacher, universities must have compelling teacher education programs (M. McDonald et al., 2014). Expectations for teacher education and certification should be aligned and based on professional standards (Luft et al., 2015). One example of such standards includes the National Science Education Standards, which assesses inquiry—a necessary skill of a scientifically literate citizen (Luft et al., 2015). Additionally, with the adoption of the Next Generation Science Standards (NGSS) teacher preparation and certification are likely to be reformed (Bybee, 2014; NGSS, 2013). Ultimately, teacher education programs provide instruction in educational theory to preservice teachers; however, to have a positive impact in the classroom, preservice teachers' exposure to sound theory must be aligned to the real-world classroom (Harrington & Enochs, 2009).

In one study of preservice teachers, researchers provided teacher education students with professional development and university supports in an effort to increase math and science content knowledge, and self-efficacy. Teacher education students were given a common planning time with other teachers, certification workshops, participation in STEM Thursdays (implementation of a science lesson three times per semester), and authentic summer research opportunities. The researchers found that self-efficacy was positively impacted as a result of the

STEM curriculum integration and school-university supports (McCollough, Jeffery, Moore, & Champion, 2016).

Additional time spent in the science classroom during teacher education classes as well, offers an opportunity to strengthen instructional methods in science. During qualitative interviews of a mixed methods study of preservice science teachers (PSTs), PSTs reported science learning gains during a teacher education practicum. The connection between the preservice teacher and cooperating teacher should be fostered to produce a stronger, more supportive relationship (Fazio & Volante, 2011). Perhaps there is a misalignment between teacher education expectations and classroom performance of teachers.

Understanding the importance of *learning by doing* is critical for preservice teachers. *Learning by doing*, moves beyond seeing and hearing to acquire science content knowledge (Dewey, 1958). Preservice science teachers acquire science content knowledge in the college classroom; however, the college classroom, by nature, is lecture-based and does not move beyond the seeing and hearing. To meet constructivist goals, instructional methods change (Dewey, 1938). Changing instructional methods in the college classroom presents challenges because the students are numerous and the professors are few. The importance lies in the idea that learners require engagement for meaningful learning to occur (Graham & Crawford, 2012).

Universities are responsible for designing teacher education with two end goals in mind, to educate the adult and child—the preservice teacher and her students. With the end in mind, field experiences should be aligned with teacher education coursework to enhance preservice teacher learning (Harrington & Enochs, 2009). Additionally, Harrington and Enochs (2009) state field experiences should be constructivist in nature to reinforce the concept of *learning by doing*. One university-science center partnership field experience has been designed to include

the opportunity for preservice science teachers to practice constructivist teaching practices in a museum internship (Saxman et al., 2010). The hope of employing constructivist teaching practices in the university classroom is that future teachers will continue to utilize constructivist teaching practices in their classrooms after gaining experience.

Field Experiences

Field experience courses are tasked with overcoming preservice teachers' preconceived notions about teaching. Teacher education courses, including and especially field experiences, influence a preservice teachers' beliefs about teaching and learning (Charalambous, 2015). Field experiences offer the opportunity for experiential learning—facilitating student learning with real-world experiences, hands-on interaction, and time in the field (Capraro et al., 2010). Field experiences have the potential to produce meaningful learning, and redirect misconceptions, through preservice teacher engagement in experiential learning opportunities.

Fletcher and Luft (2011) conducted a three-year study of preservice secondary science teachers enrolled in university teacher education courses, which required field experience hours. The study followed an interpretivist framework. Data collection included interviews and artifacts to build a case for each participant. Cross-case analysis revealed motivators for participating in field experiences. Participants reported being encouraged by their students' excitement for science. Additionally, participants declared any course with a field experience component beneficial to teacher development (Fletcher & Luft, 2011).

Study abroad can be classified as a field experience—as some study abroad participants are preservice teachers who seek multicultural education opportunities outside classroom's in the student's home country. Participating in study abroad, with the purpose of achieving multicultural education, produces a shift in perception of self and others (Sharma et al., 2011).

Acquiring new geographical insights, allows study abroad participants to understand different corners of the world after exposure to regional norms of the area traveled (Moline, 2009). Shifting perceptions of others is a beneficial addition to a future teacher's skill set that has a positive impact in the classroom and career (Francis, 2015).

Study Abroad

Originally, study abroad was intended for a privileged few but study abroad has become more accessible to a larger audience of college students. Still, only a fraction of American college students study abroad but, again, their numbers have increased. This is mostly due to the opportunities for students to study outside the humanities during study abroad—previously, study abroad experiences where targeted to humanities students. While study abroad is costly, the backgrounds of students studying abroad are varied among the students (Lewin, 2010).

There is a great deal of work that lies ahead of study abroad decision makers to increase the number of American students studying abroad. International students studying in the United States outnumber American students studying abroad—so much so, that it would take a decade to make the groups equal in number (Lewin, 2010).

The purpose of study abroad in higher education is to develop the multicultural and global awareness in university students through international experiences not offered in their everyday campus curriculum (Vatalaro et al., 2015). The global awareness of university students is developed when students participate in study abroad experiences in which they recognize diversity, collaborate with and support individuals from diverse cultures (Vatalaro et al., 2015).

Today, university students accept globalization in a way that allows them to understand the perspectives of others—some students even employ practices of other cultures (Cai &

Sankaran, 2015). This student characteristic can be achieved by study abroad lessons that encourage recognizing and respecting differences between and among cultures.

Student travelers are exposed to cultures different from their own (Sharma et al., 2011). A student's view of the world may shift, from rigid and closed to flexible and open, as a result of studying abroad and being in a new environment (Graham & Crawford, 2012). When student travelers arrive in a new country, they may be overwhelmed and even have negative experiences. Sometimes these feelings of being uncomfortable or experiencing negativity stem from the experiences that student travelers, particularly preservice teachers, have with students they are teaching in foreign countries during study abroad. These experiences also have the potential to elicit emotions, including empathy, to motivate students to understand a different point-of-view (Menard-Warwick & Palmer, 2012). One day preservice teachers will become the teacher of record in their classrooms and be responsible for providing culturally-sensitive instructional strategies to students from other cultures (Palmer & Menard-Warwick, 2012).

The experiences of study abroad students provide differences in day to day activities from their home country. While studying abroad, students experience times of disjuncture that may be disorienting; at the same time, students also have the opportunity to develop their understandings of globalization during times of disjuncture (Gieser, 2015). In this particular study abroad experience, nine students enrolled in a South African university. Seven students enrolled at the university for a semester and two students enrolled for an academic year. All students studied the university's humanities curriculum. The research purpose of this study was to explore sociocultural practices of the students while they were abroad. Researchers found students' national identities while abroad were easily identified by citizens of South Africa.

Additionally, there was a disjuncture between the perceived and actual national identities of some students (Gieser, 2015).

In one study, Chapman (2011) investigated which experiences and perspectives drive intellectual and social development. This study is guided by the following research questions: 1) What personal and career transformation occurs (or is perceived to occur) through the participation in a study abroad experience; and, 2) How does the participation in a study abroad program contribute to the development of career choices and life goal? The researcher utilized semi-structured interviews, then transcribed and read interview data, coded the data, identified themes, and substantiated data with existing literature. The researcher's university offers nearly 30-study abroad programs to various countries, including Costa Rica. The participants, 23-female and 17-male, senior, study abroad students, reported their study abroad experiences influenced their career decision-making skills. Data analysis showed the career development of the participants showed improved development during and after study abroad. Additionally, participants should be encouraged to reflect and write about their experiences during and after studying abroad, and to share their enthusiasm for study abroad upon their return with prospective participants (Chapman, 2011).

Faculty-Led Study Abroad

Three types of study abroad experiences include: 1) faculty-led topic/subject focused; 2) faculty-led engagement activity; and, 3) immersion through university semester abroad (Graham & Crawford, 2012). Graham (2012) investigated short-term, faculty-led study abroad as a transformative experience—does it equal a full immersion semester at a foreign institution? A random selection of study abroad students from a two-year period with a College of Agriculture and Natural Resources yielded 15-participants for this study. Participants were interviewed

about their study abroad experiences. Data was coded by four-researchers to establish interrater reliability. Five-types of learning were identified: 1) epistemic (changes in learning); 2) relational (as it relates to citizenship); 3) personal adaptive (changes in self-image); 4) philosophical (as it relates to defining one's self); and, 5) skills development (as it relates to study abroad). Students who experienced a faculty-led topic/subject focused study abroad or immersion through university semester abroad most cited gains in epistemic and philosophical learning. Students who experienced a faculty-led engagement activity study abroad cited gains in epistemic and personal adaptive learning. Participants of faculty-led study abroad experiences reported an increased rate of everyday learning while abroad resulting from daily reflection as part of study abroad curriculum (Graham & Crawford, 2012).

Tarrant (2010) aimed to understand the role of study abroad in boosting global citizenship. Benefits of short-term, faculty-led study abroad include curriculum content and methods of instruction. Together, these factors contribute to learning during study abroad experiences (Tarrant, 2010).

Short-term Study Abroad

Study abroad programs can range from a week (short-term) up to a year (long-term); the depth of study abroad experiences are equally varied—ranging from learning about regional cuisine to participating in service-learning in schools (Vatalaro et al., 2015). While it may be beneficial to study abroad for a semester or year, some students do not have the means or opportunity to study abroad for such a lengthy time. Short-term study abroad is a feasible alternative to long-term study abroad (Eckert, Luqmani, Newell, Quraeshi, & Wagner, 2013).

In a study of Agriculture and Life Science undergraduates, researchers examined cultural adaptation in students who studied abroad in Costa Rica, France, and Swaziland. The researcher

utilized a collective case study to identify gains in student growth. Analysis of interviews, journals, photographs, and observations revealed students experienced academic, career, and cultural growth while participating in short-term study abroad (Conner, 2013).

Study Abroad in Education

The purpose of study abroad for preservice teachers is three-fold—to encourage interactions with students from cultures other than their own, who are speakers of other languages, who come from varied socioeconomic circumstances—ultimately to understand the international student perspective (Vatalaro et al., 2015). Additionally, classroom specific objectives of preservice teacher study abroad experiences include comparing and contrasting American and foreign education systems, classroom management, and curriculum and instruction (Vatalaro et al., 2015).

During a two-week study abroad experience in Reggio Emilia, Italy, five-preservice teachers worked on building content knowledge, teaching practices, and global competencies. In this phenomenological study, researchers explored the experiences of this group of preservice teachers and the meaning the teachers made from their experiences. Researchers found participants increased content knowledge, awareness of cultural differences, and self-awareness (Vatalaro et al., 2015).

During a six-day global study abroad experience, 29-students toured classrooms to visit students in non-American classrooms. The researchers compared the input from students by exploring concept maps created before and after the global field experience. Researchers found a positive impact in student growth and understanding of effective teaching (Francis, 2015).

Chapter Summary

Chapter Two began with the theoretical framework for this study. The theoretical framework focuses on study abroad as a type of field experience for preservice science teachers during teacher education. Additionally, self-confidence was discussed as a secondary theoretical framework as the ultimate goal of participating in study abroad is that individuals develop their personal and professional growth.

A review of literature was provided on science teacher education, field experiences, and study abroad. The review of literature showed the need for improvement in science education via teacher education. Design of teacher education programs requires constructivist teaching methods, or real-world experiences, including incorporating field experiences that align theory and practice. Study abroad can be implemented as a field-based experience for preservice science teachers during times of teacher education with potential benefits including developing self-confidence in science and cultural competency.

This study had the potential to reveal science-focused study abroad experiences were a means to support field experiences for preservice science teachers to constructively develop excitement for science concepts and effective instructional methods, thereby improving their confidence in the science classroom—and by extension, positively influencing student attitudes towards science.

CHAPTER 3: METHODOLOGY

The first part of this chapter describes the methodological framework of this study, research questions, participants, and participant recruitment. The first part of this chapter also explains the process by which the data collection methods were peer-reviewed to establish trustworthiness—data collection methods in context allows for trustworthiness (Patton, 1990). The second part of this chapter explains the data collection methods used to answer the research questions of this study. The last part of this chapter explains the qualitative data analysis methods used to detail study abroad experiences, science content knowledge of preservice teachers who have participated in science-focused study abroad experiences, and the methods by which they carried out study abroad-centered activities in their classrooms.

Research Questions

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. This study was guided by two research questions: 1) what are the study abroad experiences that have influenced classroom teachers; and, 2) how do classroom teachers incorporate study abroad experiences into science curriculum planning and instruction in the classroom?

Rationale for Qualitative Methodology

Individuals personally construct meanings from experiences, making study abroad constructivist by nature (Gieser, 2015). Meanings from experiences are open to interpretation by an audience (Glesne, 2011). This study will explore the experiences of individuals who have participated in a science-focused study abroad during their time as preservice teachers.

Additionally, this study explored how these individuals applied their study abroad experiences in their classrooms as in-service teachers. Through data collection and analysis, the author is attempted to capture the essence of these individuals' experiences (Glesne, 2011).

Qualitative inquiry guided this study to provide an in-depth exploration into the role study abroad plays, if any, in supporting preservice science teachers. Qualitative inquiry allowed the study to move beyond defined variables to answer complex questions about participant experiences during study abroad (Creswell, 2014).

Cross Case Design

Selection of cases for a case study in education usually requires cases to be chosen based on a common phenomenon (Patton, 1990). A case study begins with the characteristics the cases have in common. For the purpose of this dissertation study, the commonality which cases share is the study abroad experience itself. The cases in this study are the participants of the study abroad course. Due to the nature of cross case analysis, comparing *and* contrasting the cases of the study paints a complete picture of the research purpose of this dissertation study. With that in mind, the purpose of a cross case study is to also explore how the phenomenon operates under different conditions (Stake, 2006). For the intentions of this study, the conditions under which cases, or individuals, may operate include teaching in the self-contained elementary, or departmentalized elementary or secondary science classroom—providing the aforementioned diversity across context (Figure 2). However, that is not to say random selection is an approach employed in cross case studies; rather, purposeful sampling of cases specific to the phenomenon being explored will provide the opportunity for deep investigation (Stake, 2006). Also, purposeful sampling of cases is not the highest priority in a cross case study; rather, the aforementioned diversity of cases and bearing on the study take precedence (Stake, 2006).

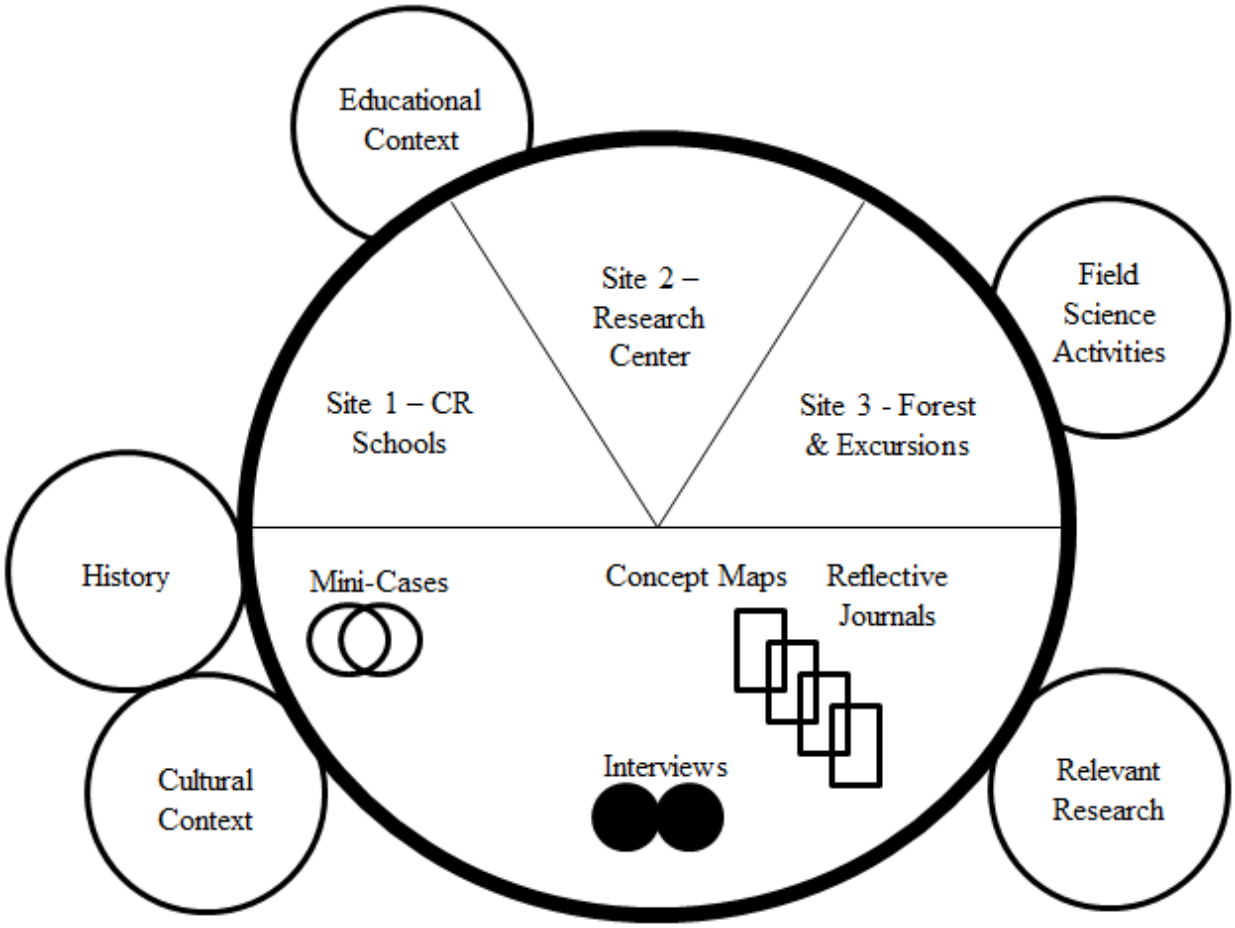

Figure 2. A visual representation of the study abroad experience and the data as they relate to the cases in this study (Stake, 2006)

The uniqueness of each case, or individual, provides an equally unique experience to contribute to the understanding of the study. An important task of the researcher is to present how the study abroad experience differs from one case to another—a qualitative necessity (Stake, 2006). It is these unique experiences will provide the context to construct the meaning made by the participants of the study abroad experience. In qualitative inquiry, researchers capture experiences through data collection. To explore the uniqueness of the cases, and the experiences, researchers observe and/or interview individuals, refer to records, and gather artifacts to understand participant experiences (Stake, 2006).

Case studies depend on qualitative methods of inquiry such as observation, interview, coding, data management, and interpretation (Stake, 2006). Difficulty arises, especially during data collection, when cases do not fit the study because an assortment of case studies are holistic in nature, meaning—if cases are too diverse, these methods are probably not appropriate to apply to the study (Stake, 2006).

Interpretations of the data must be supported by at least three pieces of evidence in order to triangulate findings (Stake, 2006). For the purpose of this study data collection will include interviews, concept maps, and field notebooks.

Study Participants

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. The two participants involved in this study were both in-service, classroom teachers and graduates of a university in the southwest region of the United States. During the time of the study abroad experience, one participant was an undergraduate student in Interdisciplinary Studies and one participant was a graduate student in the Master and Certification (MAC) program in Secondary Education. The participants had been enrolled in the course, Environmental Science and Multicultural Experience for K – 8 Teachers took place in Costa Rica during the Maymester of 2012. The two participants were assured their participation would be voluntary and confidential, and they could withdraw from the study at any time. Additionally, they have been assigned the pseudonyms of Victoria and Mitchell.

Demographic information was collected at the time of interview. Both participants are Hispanic females. Both participants reported they had not participated in study abroad before

their experience in Environmental Science and Multicultural Experience for K – 8 Teachers that took place in Costa Rica. At the time of this study, one participant was a second-year, fourth-grade teacher and one participant was a fifth-year, high school physics teacher.

Study Abroad Setting and Subjectivity

During my time as a doctoral student, I gained experience as graduate research assistant for this study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers. My experiences as a study abroad student and graduate research assistant have influenced my research interests more than any other graduate school experience. As a student and graduate research assistant for the study abroad course, I was acquainted with the participants of this study, limiting my objectivity in this dissertation study. Throughout the course of this dissertation study I maintained a researcher's journal to document my own experiences, which was detailed in Chapter 3.

The research center, established in 2009, is a 250-acre compound operated by a major university system. It is available for use by university system schools and non-system schools. The research center is comprised of a multi-purpose building which houses a cafeteria, classrooms, labs, computer lab, conference room, offices, and first aid. The entire research center is outfitted with wireless internet and is Americans with Disabilities Act (ADA) compliant. The research center has eight-bungalows on-site that can sleep 56-individuals. The research center is contained within primary and secondary rainforests which incorporate manmade hiking trails to provide learning opportunities in tropical ecology, ecosystem sciences, geosciences, public and rural health, and agriculture. Nearby grade schools and towns also provide opportunities for outreach and service learning. The research center is the site for the

study abroad experience for the course, Environmental Science and Multicultural Experience for K – 8 Teachers.

The study abroad experience was the crux for the course, Environmental Science and Multicultural Experience for K – 8 Teachers. This course was a six-hour elective offered by the College of Education to undergraduate and graduate students. Three faculty members and a doctoral graduate research assistant supervised the students throughout the trip.

During the two-weeks abroad, other student groups from the region were also studying at the research center. All meals were served cafeteria-style, daily in the campus dining room, and coffee was available all day. Participants were off-site for classroom observations and excursions. Observation debriefings, pre-lab, and post-lab were held in the campus' large-scale classroom equipped with a dry-erase board, projector, tables, and chairs—the only room with air conditioners. Research center staff was on campus 24-hours a day to facilitate hikes in the forest, supervise visits to La Fortuna and other excursions, and were available to answer any questions.

Sites and Activities

One pre-trip meeting was held at the university. Faculty members, the graduate research assistant, and all students were in attendance. After introductions and university paperwork, the faculty members discussed the syllabus and class materials. The travel itinerary and packing list were reviewed in detail. Students presented on previously assigned topics relating to Costa Rica to serve as an introduction to what the students would experience while abroad. Last, graduate student research assignments were discussed.

Flights to and from Costa Rica landed at Juan Santamaria International Airport in San Jose, the capitol of Costa Rica. All transportation to and from the airport, and in and around the

research center was by tour bus, contracted by the research center. Our first day at the research center was atypical because we arrived at 2:30 a.m. Our group had a late breakfast to accommodate our delayed schedule. Breakfasts at the research center consisted of eggs and a breakfast meat, assorted tropical fruits, *gallo pinto* (a Costa Rican black bean and rice dish), cereal, peanut butter and jelly, coffee, tea, and water daily. Most days followed a similar schedule: breakfast at the center, morning observations at the Costa Rican schools, multicultural seminar, lunch at the center, science seminar and field studies, dinner at the center, and homework. Occasionally dinners in the nearby town of La Fortuna punctuated the week, as individuals had to run errands "in town."

On our first day, we were given an orientation to the research center after breakfast and a tour of the forest after lunch. The director of the research center facilitated the orientation, discussing exports of Costa Rica, the mission of the research center, and areas of future research. During our first tour of the forest our guide stopped frequently along the five-mile trail to point out different species of plants, insects, frogs and birds. Lunch and dinner, like breakfast, were very similar from day to day. Each lunch and dinner consisted of a meat and a vegetable, with *gallo pinto* and salad topped with oil and vinegar.

We began our classroom observations on the second day. There were three campuses we visited during our time in Costa Rica. An elementary campus and a secondary campus were downhill, in walking distance, from the research center and one elementary campus was on the opposite side of the village, a short drive away. Only a few students, in two small groups, were able to visit the third campus. For our first observation we were at the elementary campus, downhill from the research center. The school building was small, open-air, and had a small, attached room for meal and snack times—provided by the school. The students, in their

uniforms, were both shy and excited to welcome us to their school. That morning, nine-students in grades 3, 4, and 6 were in attendance and working on place value with interactive notebooks and calculators at three small groups of desks. After their math lesson, the students had a snack of rice, beans, and *platanos* (fried, unripe plantain bananas similar to a potato). After snack, students received a lesson in Spanish. The teacher began by activating prior knowledge by asking the students questions. Most students worked in leveled readers while the teacher worked with a small group at her desk. The participants, new to this classroom environment, either helped students with their work or observed the students and teacher. One participant did a show-and-tell with her iPad while the students watched in amazement.

That afternoon, we had pre-lab in the classroom. We discussed the differences among palm trees, hard wood trees, woody vines, and epiphytes. We reviewed related vocabulary and discussed the relationship between physical variables and biodiversity in the forest. After pre-lab, we hiked into the forest to construct a 10-meter transect down the sloped side of the hiking trail. Each group used a clinometer to find the slope of the transect. In our groups, we investigated the plant biodiversity by surveying the transect and taking a count of the types of plants present.

That night we opted for an early dinner at the research center. After dinner, we took an 'errands only' excursion to La Fortuna, the nearby town. La Fortuna, named after the fortune of not being affected by the last volcanic eruption of nearby Mount Arenal, has a small town square straddled by St. John Bosco Catholic Church, gift shops, restaurants, a grocery store called *El Super*, and other stores. Tour buses are present on every side of the town square, ready to shuttle visitors to their next destination. Beyond the town square are small neighborhoods and family farmlands, with tourist destinations just on the outskirts of town.

On the third day, we returned to the elementary campus downhill from the research center. When we arrived the students sang a song called *Amistad*, which loosely translates to Circle of Friends. The students also sang a song, whose title translates to We Are Workers, the subject of the chorus. Between choruses, the students each took a turn saying and acting out the job they would like to have when they grew up. Most, if not all, of the jobs the students shared in the song could be identified as a skilled trade or manual labor. Students began their health and science lessons next. Sixth-graders worked on energy and magnetism, fourth-graders worked on identifying characteristics of physical and sexual abuse, and third-graders worked on a nutrition lesson. Students had workbooks in which they were highlighting the main idea of each paragraph. When students finished their health and science lessons, they played a modified version of Jenga® which included Spanish words with their English translations. The students were excited to show off their knowledge of the English language. Few participants were interactive with the students, still warming up to this new classroom. One student, who had been admiring a participant's cursive writing, received a lesson in cursive writing. The participant drafted the dashed lines to create the letters and the student eagerly followed the dashes with his pencil.

In lieu of a field exercise in the afternoon, the group took an excursion to nearby Mount Arenal, a now-dormant volcano which last erupted in 1968. The group hiked the mostly-flat trails around the base of the volcano through areas of secondary succession, areas now full with vegetation after being destroyed by the last volcanic eruption. At the end of the trail, there was a steep hike to the top of a lava flow—an area of primary succession, with little signs of life. From the top of the lava flow, an area where lava pooled and cooled, you could see all the way to Lake

Arenal, the largest lake in Costa Rica. It houses a hydroelectric plant that plays a major role in Costa Rica's concerted effort to sustain a green environment.

That evening, the group participated in a night hike. The group met in the classroom to discuss a nighttime adaptation of the forest animals. The eyes of animals contain what is called a *tapetum lucidum*, which translates to 'carpet of light,' a structure at the back of the eye which reflects what little light is available at night to improve animal night sight. We hiked the forest trail in search of reflecting tapetums. In pairs we took a count of the tapetums we observed. Spider tapetums are blue, frog tapetums are green, and cat tapetums are yellow.

On the fourth day, the larger part of the group continued observations at the elementary school down the hill. I supervised a small group of participants at the third campus, an elementary campus on the other side of the village. This campus housed pre-kindergarten through grade three and employed approximately three adults: a teacher, a teacher/principal (the sister of the research center's Operations Manager), and a cook that prepared the students' meals provided by the government. The entire campus was completely fenced in, and open-air. The walls where painted with school-related murals. Including students from all grades, there were five-boys and four-girls, all in uniforms of light blue button down shirts and black shorts.

The pre-kindergarten/kindergarten room I observed had four stations for the students to rotate through: a play-kitchen area, a Lego station, a sewing station with lacing cards, and a nap time station. The third-graders were in the middle of a math lesson when I observed their class. The students worked in workbooks and their lesson covered steps to solving addition word problems. The small group of participants worked with students completing their math work. During our time at this campus, students also had snack time and recess. Snack time started with a rendition of *Las Mañanitas*, the Latin American birthday song, and a prayer. The students'

snack consisted of root vegetables in broth. After snack time, the students washed their hands, brushed their teeth, and played in the yard for recess. Before we left, we were treated to a practice dance performance by some of the older girls would later perform at a town celebration. They danced to Without You by David Guetta and Usher.

Later that afternoon, during our field science seminar, we conducted a post-lab discussion for the night hunt activity and the vegetation-transect activity. Additionally, we hiked into the forest to collect weather condition data including dew point, relative humidity, absolute humidity, barometric pressure, absolute altitude, and temperature. We left the field early to get ready for a special dinner with the faculty members of the campuses we had been visiting for observations. Over dinner, the group discussed the differences between American and Costa Rican education systems.

On the fifth day, we visited the secondary campus downhill from the research center. The first classroom we visited was an eighth-grade English classroom. There were six students in this class—four-girls and two-boys. Students were studying new vocabulary and practiced past-tense verbs. The students in the classroom were using Spanish-English dictionaries and workbooks.

The teacher of this classroom also taught History, Biology, and Geography. She had been a teacher for ten-years, three of which had been spent at this campus. Resources are very limited at this campus; the teacher purchased her own computer and made student packets at home. Other struggles she faced included English not being taught until seventh-grade and her hand-me-down history curriculum about the History of Mexico.

The next classroom we visited was a science classroom. The class was comprised of 22 students—seven-girls and fifteen-boys. Students were on-task and working in interactive

notebooks. The students were studying stoichiometry word problems—counting and balancing the products and reactants of chemical reactions.

The last classroom observation was in a biology classroom. There were eleven-students in this classroom—seven-girls and four-boys. Students were taking notes about plant characteristics from the teacher's lecture. The topics they covered included insects and pollination, fruiting trees, flowers and insect pollinators, types of insects, plants which bloom at night, and plants and bird pollinators.

The topic of the field science seminar that day was map reading and orienteering. In large groups, we interpreted topographic maps to interpret what the landscape would look like. We also learned how to measure distance on a map. Our professor explained how to use a compass for determining direction, a skill we would need in other field studies. To practice, we hiked into the forest in our small groups to create a scavenger hunt for another team. We had to record our path through the forest, including number of steps and cardinal and primary inter-cardinal directions. A survey flag marked the end point of our path. Among the groups, we switched our recorded directions and attempted to capture the other group's flag using the directions they recorded while setting out their survey flag. On our hike back to the research center, we stopped by the *ranario*, a frog pond back at the beginning of the trail, to observe a basking Ebony Keelback, a snake native to Costa Rica. That evening, we drove to La Fortuna for dinner to commemorate our first week in Costa Rica and to celebrate the upcoming weekend excursions.

The next morning, we were up at daylight, 5:00 a.m. in the tropics 365 days a year, for an early breakfast. We were traveling to tour the Pacific Coast of Costa Rica. The road trip was four-hours to the beach punctuated by restroom breaks and shopping stops along the way. On

the way to the beach, we passed a farm where there was a herd of water buffalo whose milk was used to make mozzarella cheese. We spent a significant amount of time at the Tarcoles Bridge, observing crocodiles from a highway overpass. The large reptiles were either basking or swimming to keep cool in the humid summer sunshine. When we arrived to Jaco Beach, the unfailing afternoon rain was coming down so we had lunch at the Brown Box, Costa Rica's version of a chic French bistro. The sandwiches, salads, and quiche were welcomed treats after so much fruit, rice, beans, and salad. After lunch, we walked to the beach. To our surprise the beach was very different from the beach we were used to. Jaco Beach was a black sand beach, derived from the continual erosion of volcanic rock by the ocean. The beach was covered in large pebbles and the surf was rough; few people entered the water, which included the occasional surfer. On the way back to the research center, we stopped at a fruit stand and sampled some of Costa Rica's finest fruits.

The next day was also a day of excursions. Our morning excursion included a rafting safari and our afternoon was spent at a hot springs resort. On the way to the rafting safari, we stopped to observe a three-toed sloth at the top of a cecropia tree and learned about their habitat and behaviors. The rafting launch was nearby on the Peñas Blancas River. We put on our safety gear and the entered the river. We traveled the river for about two hours. We observed the layers of the rainforest, the vegetation, and the animals which inhabited it. The highpoint of the trip was watching a troop of howler monkeys in the trees, crossing the river.

After lunch in La Fortuna, we made our way to Baldi Hot Springs Hotel, Resort, and Spa. At the resort, there is a series of pools naturally heated by nearby Mount Arenal. As you make your way through the resort, the pools become warmer as you get closer to the volcano. The water is also rich in minerals, which the resort claims to have healing properties.

We began our second week in Costa Rica by touring the local hydroelectric plant. Costa Rica is a highly green-conscience country—recycling centers abound and very little electricity is used by local communities. The hydroelectric plant is built on the Peñas Blancas River. The day we were there, the staff was dredging the reservoir so it would hold an increased amount of water. We were issued hard hats and earplugs so we could tour the turbine housing below the surface. After the hydroelectric plant tour, we visited an adjoining aquaculture research station. The purpose of the research station is to study the health of the fish in the Peñas Blancas River.

We returned to the research center for our afternoon field studies. We were to calculate the relative elevation of a raised terrain in the forest to ultimately create an elevation profile of the area. We roped off an area of rough terrain, measured the area's characteristics, and calculated the incline of the surface of the terrain.

On the ninth day of our experience, we returned to the elementary campus downhill from the research center. During our observation time, students were having their math lesson. Kindergarteners were learning about numbers and second-graders were learning about place value. After the students' math lesson, the students entered a transition time between two lessons. The teacher did a breathing exercise with the students, and then the class participated in story time with the teacher. By this time in the study abroad experience, participants had become comfortable enough to regularly interact with the Costa Rican students during our visits. Having completed our observations at the Costa Rican schools, we spent a significant amount of time during our multicultural seminar that morning after breakfast to process noteworthy moments from our study abroad experience.

During our field study pre-lab later that day, we reviewed soil science vocabulary. We also discussed the process by which epiphytes, plants which live on other plants, create epiphytic

soil. We hiked into the forest to collect soil samples, specifically epiphytic soil and topsoil. We returned to the wet lab in the main building. We prepped our soil samples in the wet lab for nutrient storage testing the next day.

On the tenth day, we utilized our prepared soil from the forest to quantify the nutrient storage of our samples. For each sample, topsoil and epiphytic soil, we used soil sampling kits to identify the amount of nitrogen, potassium, and phosphorus contained within the soil. We also tested the pH of each soil sample. We concluded by reviewing the nitrogen cycle which is present in the environment, including the processes of nitrogen fixation and denitrification.

During the second half of field study, we reviewed the water cycle to serve as an introduction to the next activity, determining water velocity. During the second half of our field study, we trekked down to Rio Chachagua, the small river half-way between the research center and nearby schools. We measured a ten-meter transect perpendicular to the river. We then framed ten one-meter increments within the transect. For each frame, we measured the time it took a tennis ball to float a distance of one meter across the transect. Having time and distance data, we were able to calculate the speed of the tennis ball, and by extension the speed of the river. With our compasses, we used compasses to find the direction of the flow of the river and we were able to calculate the velocity of the river. During post-lab we employed the same water velocity calculations to find how long it would take Rio Chachagua to cover the playing surface of our city's minor league baseball field. Before class was over, each group did a blind draw for their problem-based learning final exam question for the next day.

For our last excursion of our study abroad experience, we had dinner at a local tilapia farm in the village. We toured the aquaculture ponds on-site. Our host, the owner of the tilapia farm, spoke with us about the role fish play in the diet of local Costa Ricans. As a special treat,

the staff of the tilapia farm hosted dinner for our entire group. On the menu—tilapia: whole fried tilapia (head and all), fried filets, and sautéed filets in cream sauce.

The morning of our last day abroad, students presented their lesson plans which emphasized a particular strategy for English language learners—a graded requirement for the class. After presentations, our groups gathered our field materials and headed out to the field to complete our final exam tasks. Each group's task was designed to take a problem-based learning approach to resolving a local environmental concern. The content of final exam tasks was aligned with the lessons carried out over the last two weeks of field studies.

In the grand tradition of "early to bed, early to rise," we packed all of our belongings on the last night. We departed from the research center at 2:00 a.m. to take the three-hour drive back to the airport and begin our trip home from our sojourn in beautiful Costa Rica.

Data Collection

Before data collection could commence, permission from the university's Institutional Review Board (IRB) was required. After permission to conduct research was granted, during recruitment, participants were assured that their participation was voluntary and confidential, and that they were able to withdraw from the study at any time. The researcher received informed consent from each of the participants.

This study utilized participant-generated concept maps to capture acquired science experiences as a result of study abroad in preservice teachers (Greene et al., 2013). In-depth, semi-structured interviews with participants were conducted and transcribed to construct participant perspectives and coded to contribute to evolving categories and themes (Huber, Caine, Huber, & Steeves, 2013). Field notebooks which contained information from field lessons while participants studied abroad in Costa Rica also underwent content analysis (Glesne,

2011). Each data collection strategy for concept maps, interviews, and field notebooks—contributed to the data corpus and as they were analyzed, contributed to newly-formed categories and themes in an effort to triangulate data (Denzin, 2012; Lincoln & Guba, 1985). Most importantly, this study sought to identify factors that influenced science confidence in preservice teachers during study abroad experiences.

Concept Maps

Participants constructed concept maps to demonstrate experiences acquired during study abroad in Costa Rica (Greene et al., 2013). The domain, or central node or topic, of the concept map was the experiences of studying abroad in Costa Rica (Hay & Kinchin, 2006; Kinchin, Cabot, & Hay, 2008; Kinchin et al., 2000). Concept mapping is a reliable, valid means to demonstrate science experiences—especially in science education (Greene et al., 2013; Kinchin & Cabot, 2010; Van Zele, Lenaerts, & Wieme, 2004).

Concept maps are visual depictions of how individuals organize their knowledge about a given topic (Greene et al., 2013). Concept mapping is especially beneficial to this study because concept mapping triggers reflection and reflection plays a critical role in the theoretical framework of this study—experiential learning theory (Kolb, 1984; Villalon & Calvo, 2011). Utilizing concept maps in science education research is a useful method to convey the content knowledge of a science teacher; furthermore, utilizing concept maps can also identify acquisition in content knowledge (Greene et al., 2013).

Concept mapping was first used in a Cornell University longitudinal study in Ithaca, New York in the early 1970s. First and second grade students received audio-tutorial science lessons and were interviewed several times. Ausubel's Assimilation Theory of Cognitive Learning framed the study. In an effort to understand what students already knew so that researchers

could fill the gaps of science learning, concept maps were utilized to visually represent student knowledge in a hierarchical framework supported with related concepts (Novak, 1990).

Concept mapping allows an individual to create a visual depiction of the interrelatedness of science experiences within a given domain as the individual understands them (Greene et al., 2013; Novak, 1990). There are components of concept maps which represent specific types of information in a concept map. Greene et al. (2013) defined the components which make up a concept map as follows: 1) Node – a word or phrase that represents a key concept; 2) Primary node – a central theme within the concept map; 3) Link – a connecting line between two nodes; 4) Proposition – a label within a link between two nodes; 5) Chunk – a non-primary node with more than one subordinate nodes; 6) Hierarchy – a group of concepts with the top-most node linked directly to the primary node; 7) Cross-link – a link connecting nodes in different hierarchies; 8) Level – the number of links connecting a nod to the central theme (i.e. the primary node); and 9) Width – the number of nodes at the level with the greatest number of nodes. These components work together to establish the structure of the concept map.

An example concept map about an arbitrary topic was provided to participants before they were asked to construct their own concept map (Wheeldon & Faubert, 2009). Also, to familiarize participants with the idea of constructing concept maps, each participant was provided with 30-minutes of training before concept map creation. Participants were asked to include key experiences from their study abroad time in Costa Rica—including successes and challenges, not to exceed one page (Wheeldon & Faubert, 2009) was allotted 30-minutes to create his or her concept map. Each participant was provided paper and pencil to create a visual depiction of his or her content knowledge about a central theme—which, for the purpose of this study, was to answer the aforementioned research questions (Greene et al., 2013).

Concept maps can be coded qualitatively to give insight as to how developed the recall of the individual who created the concept map (Kinchin & Cabot, 2010; Kinchin et al., 2000). The morphology of a concept map is the indicator of how developed an individual's recall is—employing qualitative data analysis allows for the exploration of the concept map, moving beyond marking it correct or incorrect (Hay, 2007; Kinchin et al., 2000; Popova-Gonci & Lamb, 2012). The greater the complexity of the concept map, the more connections within the individual's content knowledge. The building blocks of the concept map are made of the individual's experiences. Concept mapping also allows for the identification of misconceptions. Identification of misconceptions within the concept map—and by extension, the individual—occurs when the concept map is missing new information or the concept map lacks a link between related concepts (Safdar et al., 2012).

Qualitative analysis of concept map morphology serves constructivist theory in that it is an indicator of the meaning that an individual has constructed (Kinchin et al., 2000). Concept map morphologies can be classified as spoke, chain, or net (Kinchin et al., 2000). The names of these classifications are based on the shapes the concept maps take. The spoke concept map takes on a radial shape where all nodes are connected to the primary node alone. The chain concept map takes on a linear shape where each node is only connected to those nodes directly above and below itself. The net concept map takes on a highly-connected shape where hierarchies within the concept map are apparent (Kinchin et al., 2000). Analysis of participants' concept maps, allows the researcher to identify the concepts and connections the participants have learned.

Utilizing a concept map to frame participant experience allows insight into the participant's meaning. However, since a concept map only provides the framework for an

experience, participant experience can be further explored via participant interview—especially to identify the connections between experience and the role of the participant in the classroom (Wheeldon & Faubert, 2009). Building on the framework of a concept map, with data gathered from participant interviews, paints a more complete picture of participant experience and classroom instruction.

In this study, after concept map construction and interviews, participants wrote a new reflection about their process constructing their concept map. No writing prompt was provided; instead, participants journaled their memories from almost five years before in response to the concept map. During data analysis, the combination of concept maps and reflective journaling gave a clear picture of the impact the experience had on them. Concept map reflections were processed via content analysis. Reflections were read and reread for noteworthy data in relation to answering the research questions. Striking excerpts underwent analysis in the primary and secondary cycles of coding.

Interviews

Initial development of interview questions was based on the author's experiences studying abroad, which was also experienced by the participants. The interview questions probed participants about experiences during pre-departure, arrival in Costa Rica, time spent in the forest at the research center, time spent in the Costa Rican classroom, time spent in the college classroom while abroad, and downtime and reflection.

Interviews followed participant identification, IRB informed consent, and construction of concept maps. Probe-based interviewing served the purpose of evoking the memory of the participant(Stake, 2006). Concept maps in this study acted as a probe. Each participant met with the author in a mutually-agreed upon location. Participant interviews were audio-recorded and

author transcribed each participant interview. Each participant reviewed a copy of his or her interview transcript during member checks to verify the accuracy of transcription (Harvey, 2015; Lincoln & Guba, 1985). Follow up interviews with participants were conducted to further probe areas that warranted deeper exploration (Lincoln & Guba, 1985).

Field Notebooks

Participants provided artifacts—field notebooks—from time spent in the Costa Rica (Merriam, 1998). Field notebooks contained pre-lab notes, data collected during time spent in the field, post-lab notes from in-class discussion, and reflective journal entries made during the study abroad. Each field notebook was scanned and saved by the author and returned to the participants. A specific kind of field notebook was utilized during the study abroad experience in Costa Rica. Each participant was issued a Rite in the Rain® field notebook. The benefit to using a Rite in the Rain® field notebook is each page is coated so that it is water-resistant—especially important when collecting data in the *rain*forest. Whether wet or dry, Rite in the Rain® field notebooks can be written in with regular pencil. Each participant kept her field science activities data and reflective journal entries in the field notebook. A list of science-focused field experiences which occurred during the study abroad experience, also experienced by participants, has been included (Appendix D).

Field notebooks can be processed via content analysis to generate coded data that will develop into categories and themes to be substantiated with scholarly literature (Glesne, 2011; Merriam, 1998; Saldaña, 2009). Field notebooks, specifically reflective journal entries, underwent content analysis to so that I could generate descriptive codes via primary and secondary coding to contribute to evolving. Reflective journal entries were composed in response to writing prompts developed by the faculty members for the course. Reflective journal

entries were read multiple times and excerpts of salient, meaningful text were highlighted as they related to the research questions of this study and the excerpts went through the manual sorting in primary and secondary cycles of coding.

Data Transcription Methods

Interview data was recorded on a digital audio recorder. I listened to interviews multiple times and created the transcript from recorded data. When initial transcription was complete, the researcher listened to the interview data a second time, while following along with the interview transcript and made edits as needed. The researcher created memos after the interview transcript was created.

Data Analysis

The purpose of a cross case analysis is two-fold. Cross-case analysis of the data will achieve these purposes. Cross-case analysis will be employed to explore what is distinctive about each case, as well as what is shared across the cases (Stake, 2006). While the cases share a common phenomenon, participating in Environmental Science and Multicultural Experience for K – 8 Teachers, research methods allowed for a look beyond the superficial commonality to the deeper affects shared among the cases.

The purpose of this study was to understand the study abroad experience, both the intricacies of each case as well as the commonality among the cases (Stake, 2006). After the conclusion of cross-case analysis the evidence from the individual cases was used to support the findings regarding the participants' study abroad experience.

Keeping the research questions in mind, I perused the data collected and analyzed for each participant, and kept notes to document how the participants' experiences aligned with the

research questions. I documented evidence within participants' data which supported findings about the study abroad experience.

Concept Maps

Qualitative analysis of participant-created concept maps allowed the researcher to move beyond marking the concept map as simply correct or incorrect, and allows the researcher to explore the connections among the concepts within an individual's study abroad experiences (Hay, 2007; Kinchin et al., 2000; Van Zele et al., 2004). The general morphology of a participant's concept map was an indicator as to the level of a participant's study abroad experience recall and (Kinchin et al., 2000) unique interactions among the concepts within a participant's experiences signified the participant's understanding of a scientific domain—signifying a growth in self-confidence (Kinchin et al., 2000).

Each participant's concept map was classified as spoke, chain, or net (Kinchin et al., 2000). Patterns within the concept maps were explored—specifically linking phrases, cross-links, and map structures (Novak & Canas, 2008; Popova-Gonci & Lamb, 2012). Additionally, each participant wrote a reflection of his or her concept map. Participant reflections of concept maps were processed via content analysis.

Qualitative analysis of concept maps allowed the researcher to build a deeper understanding of the participant and his or her construction of knowledge because the combination of concept mapping and interviewing was more comprehensive than interviewing alone (Sellmann et al., 2015). Additionally, following up participant concept map construction with participant interviews allowed me to build on the framework provided by the participant's concept map to further understand experience and understanding (Wheeldon & Faubert, 2009).

Interviews

The text contained within participant interview transcripts will underwent content analysis to explore how in-service science teachers incorporate study abroad experiences into curriculum planning and instruction in the classroom (Glesne, 2011). Passages of text were read by the researcher, and examined for the presence of meanings of experiences of participants during study abroad in Costa Rica. During the primary round of coding—holistic coding—each meaning was assigned a code, either a word or phrase, that captured the essence of the participant's experience (Saldaña, 2009). The goal of holistic coding is to split large chunks of interview transcript into smaller, more manageable chunks of data while creating codes (which describe the participants' experiences (Saldaña, 2009). These holistic codes were managed, and similar codes will be placed into categories.

During the secondary round of coding—pattern coding—categories of similar codes were named based on the similarities codes share (Saldaña, 2009). In an effort to craft category names, the author sought out patterns among the codes to construct a theoretical foundation for this study (Saldaña, 2009). Categories of the same vein were grouped together to develop themes among the experiences of the participants while studying abroad in Costa Rica.

Field Notebooks

The text contained within participant field notebooks underwent content analysis to explore how participants documented their study abroad experiences (Glesne, 2011). Passages of text were read by the researcher, and examined for the presence of meanings of experiences of participants during study abroad in Costa Rica. During the primary round of coding—holistic coding—each meaning was assigned a code, either a word or phrase, which captured the essence of the participant's experience (Saldaña, 2009). The goal of holistic coding was to split large

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Data Organization

In qualitative research, data must be organized in a way that allows the researcher to retrace her steps from themes to data collection if needed. Interview audio material was kept only for the purpose of transcription. When transcription was solidified, recorded interviews were deleted from the researcher's computer and digital audio recorder. Interview transcripts were stored on the researcher's password-protected computer under the participants' pseudonyms. Transcripts were printed for use during this study; but, only the participants' pseudonyms were available on transcripts. Pseudonyms were only known by the participants and the researcher. Researcher memos were kept in the researcher's journal to document the process of data organization.

Trustworthiness and Rigor

What reliability is to quantitative research, trustworthiness is to qualitative research. One approach to establishing trustworthiness is to present the subjectivity of the researcher in the context of the dissertation study. For the purpose of this study, the researcher discussed her role

in the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers. Additionally, I provided an in-depth account of my study abroad experience.

A second approach to establishing trustworthiness is to utilize multiple modes of data collection to enable triangulation of data to crystallize the themes that are identified to support the study. In this study, I had participants create concept maps which described their study abroad experience. I also conducted interviews to allow the participants to relay their study abroad experience in their science curriculum planning and classroom instruction. Last, the participants provided their field notebooks which contained their reflective journal entries.

Member checks and peer de-briefing allow involved individuals' perspectives to inform the researcher and the research process. After interview transcription, participants were provided with a PDF copy of their interview to verify the information contained within the transcript. I met with one peer reviewer to polish interview questions before interviews commenced. Additionally, I met with an additional peer reviewer to review data analysis. As noted in the IRB protocol, the peer de-briefer had access to the data (but not the participants' identities). As data was made available to the peer de-briefer, it was reviewed and reported on. The peer de-briefer discussed redundant points, points that were de-emphasized, she identified data that was over-simplified that merited detailing, and she also noted errors in the data (Saldaña, 2009). Last, the researcher's journal outlines the steps I took to document the research process. The researcher's journal was frequently referred to during data analysis to confirm the context in which the data was collected.

Triangulation

Triangulation in qualitative inquiry, including cross case analysis, assures the researcher the data is conveying the message as it was intended and the message is not oversimplified

(Stake, 2006). One way to limit oversimplifications of interpretations is take multiple passes at sources of data (e.g. interview recordings are listened to over and over). Another way to triangulate data is to have another person to take multiple passes at processing data. Two interpretations may come together or differ, in which case differing interpretations are both reported and supported by scholarly literature (Stake, 2006). Both the researcher and a peer reviewer took multiple passes at data sources. Additionally, on several occasions, the researcher and peer-review discussed possible codes which captured the essence of the data and, moreover, the difference between the two participants.

Member Checks

Member checking in qualitative inquiry is another method to ensure the message conveyed by data is not oversimplified. After data collection has occurred and drafting a report, the researcher may ask the participant to review the report in an effort to identify any misrepresentations (Stake, 2006). After the participant reviews the report, the researcher may make changes as needed, as recommended by the participant. Potential for misinterpretations lies in the idea two individuals may have two different interpretations for one concept, referred to as multiple realities (Stake, 2006). Triangulation aids in the identification of multiple realties. Each participant received a copy of their interview transcript, and I made sure if either participant was concerned about the interpretation of the participant's input, she should contact me to discuss the concern. Neither participant reported concerns about their interview transcripts.

Peer De-briefing

The author utilized the help of a peer de-briefer to establish the trustworthiness of this study (Glesne, 2011). The peer de-briefer was an individual who was not a stakeholder in the

outcomes of this study but was knowledgeable about the purpose and scope of this study and familiar with similar data collection and analysis (Hail, Hurst, & Camp, 2011). The peer de-briefer in this study *did not* participate in the study abroad experience, with the researcher's intention of providing an outsider's perspective; but, she was a National Board Certified middle school science teacher and doctoral candidate researching science education. As a middle school science teacher, the peer de-briefer was able to consider connections between the participants' experiences and classroom applications of study abroad experiences. The peer de-briefer allowed the researcher to spring-board ideas in a collaborative way which helped data analysis (Schwandt, 2007).

Researcher Journal

Throughout this study, the researcher kept a detailed journal to document research memos about the research process or participant interactions. Additionally, the researcher's journal included the researchers thought process, questions that arose during the study, and resolutions to concerns about the research process.

This study demonstrated trustworthiness and rigor through triangulation—multiple sources of data—and the use of member checks, peer de-briefing, and researcher's journal. Also for the purpose of this study, I discussed my subjectivity as it relates to this study.

Chapter Summary

In this chapter, the research purpose and questions were reiterated to make a connection with the use of qualitative research, specifically cross case analysis. The roles of the researcher and the participants were expanded to clarify the impact on this study. Elaboration on the research center and the science-focused activities has provided a context for the study abroad experience. Data collection and analysis for the three sources of data: concept mapping,

interviews, and field notebooks, were described in detail. Last, approaches to establishing trustworthiness were described. In the following chapter, findings about the study abroad experience will be discussed and supported with evidence from participant data.

CHAPTER 4: Results

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction (Figure 3). The participants' concept maps, interview transcripts, and reflective journal entries, as well as the researcher's journal were analyzed to identify four themes. The four themes resulting from data analysis were Experiencing Science in Costa Rica; Studying Abroad in Costa Rica; Transferability of Science Experiences; and the Multicultural Classroom (Figure 4).

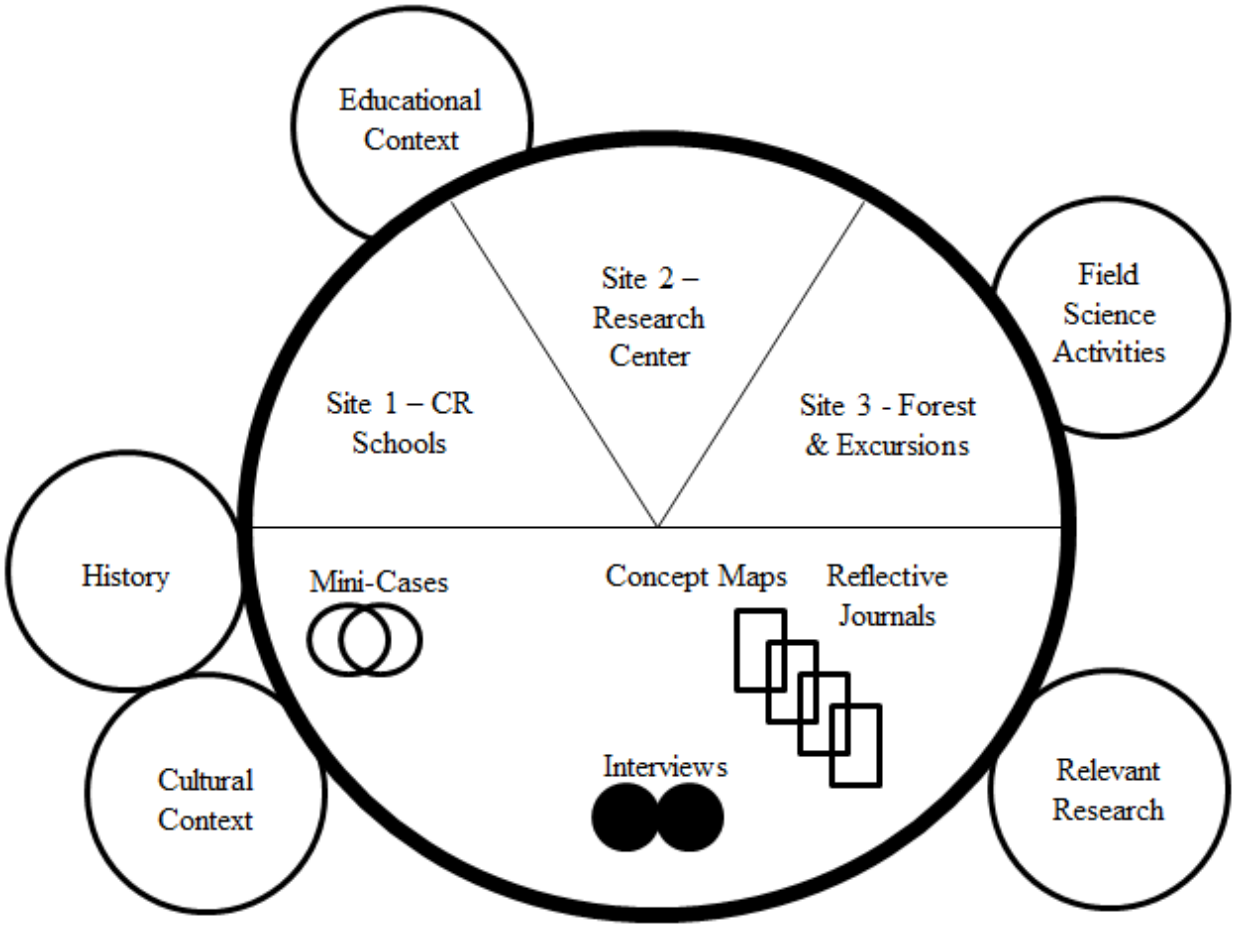

Figure 3. A visual representation of the study abroad experience and the data as they relate to the cases in this study (Stake, 2006)

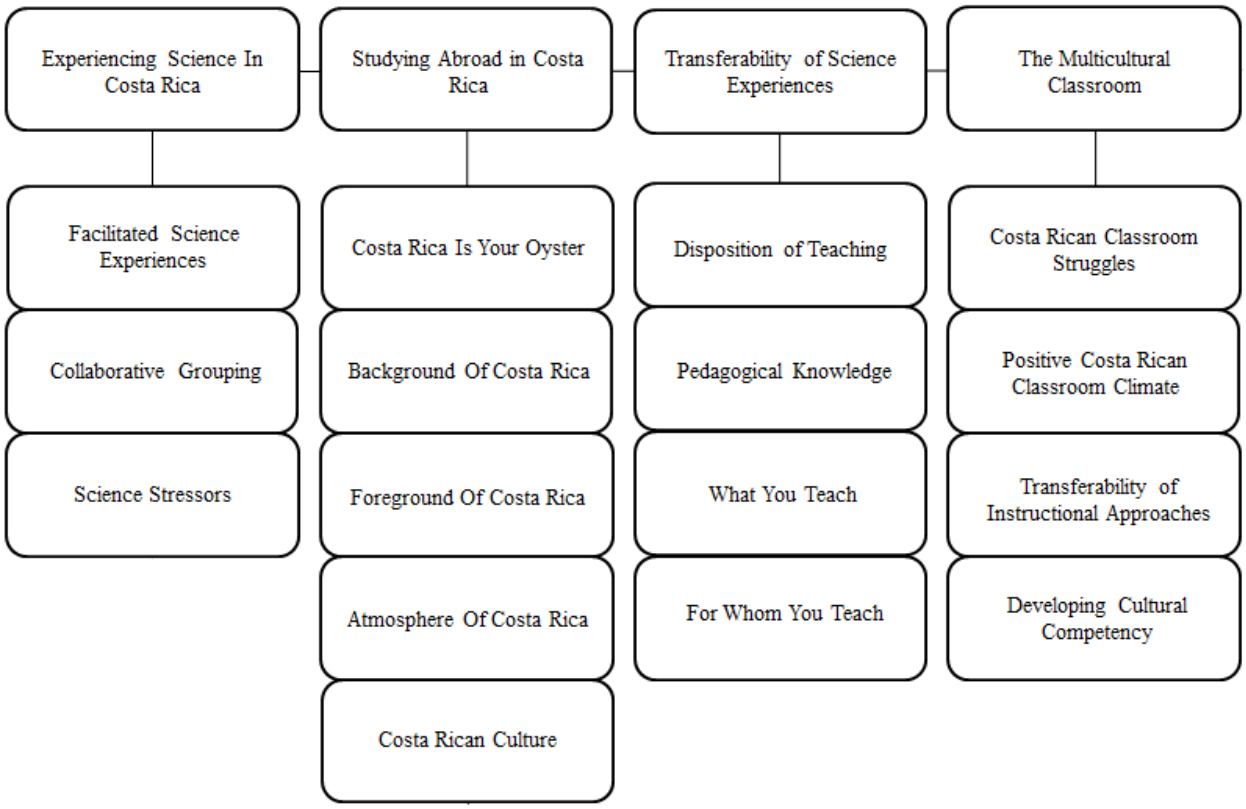

Figure 4. A visual representation of the themes and their respective categories

Case 1 – Victoria

The study abroad experience to Costa Rica was Victoria's first trip to Costa Rica and her first trip outside of the United States. This experience was Victoria's first experience traveling abroad and studying abroad. Victoria was enrolled in the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers, as an undergraduate student. During the study abroad experience, Victoria was a preservice teacher working on a bachelor degree in interdisciplinary studies.

Victoria is a certified classroom teacher. She holds a teacher certificate as a Generalist for grades EC - 6. She has been the teacher of record in her classroom for two years. Victoria teaches at an elementary campus in a district which has approximately 39,000. The school district Victoria works for operates on a traditional school year calendar.

Concept Map

A benefit of using concept maps in this study, is that participants were able to recall their study abroad experience. Additionally, they were able to refer back to the concept map during the interview. Victoria's concept map contributed to the following categories: Facilitated Science Experiences, Collaborative Grouping, and Atmosphere of Costa Rica (Figures 5 and 6).

On the back of Victoria's concept map, from the node "Tour," Victoria listed tilapia, fish, tanks, ICE plant (a hydroelectric plant), dam, river, and beach. All of these items Victoria listed, referenced science-focused excursions which took place outside the research center. Each of these items contributed to the category, Facilitated Science Experiences. In her interview, she added, "I don't think it was just one thing, it was a lot of little things that, uh, that made you open up your eyes to different learning experiences." These different learning experiences play a role in establishing the first stage of Kolb's Experiential Learning Theory, concrete experience.

On the front of Victoria's concept map, from the nodes "Groups," Victoria listed leader and followers. These parts of her concept map contributed to the category Collaborative Grouping. She admitted,

> Well I think it was it was a little different because the groups that we had, some of us had a lot of experience and knowledge about science, and I felt like at that time I…I didn't have enough and wasn't exposed to a lot, so all the new things I was learning. Uh, it was nice to see a different perspective of somebody that that actually, you know, maybe had taught or knew it.

From the node "Forest," on the front of Victoria's concept map, she described the rainforest characteristics in their natural state. In her interview she remembered, "It was nice to

see and hear the sounds of the animals. It was so enormous. We seem like itty bitty people in this enormous forest of beautiful, natural environment." This facet of her concept map contributed to the category, Atmosphere of Costa Rica. The following figures are photographs of the concept map Victoria created prior to our interview.

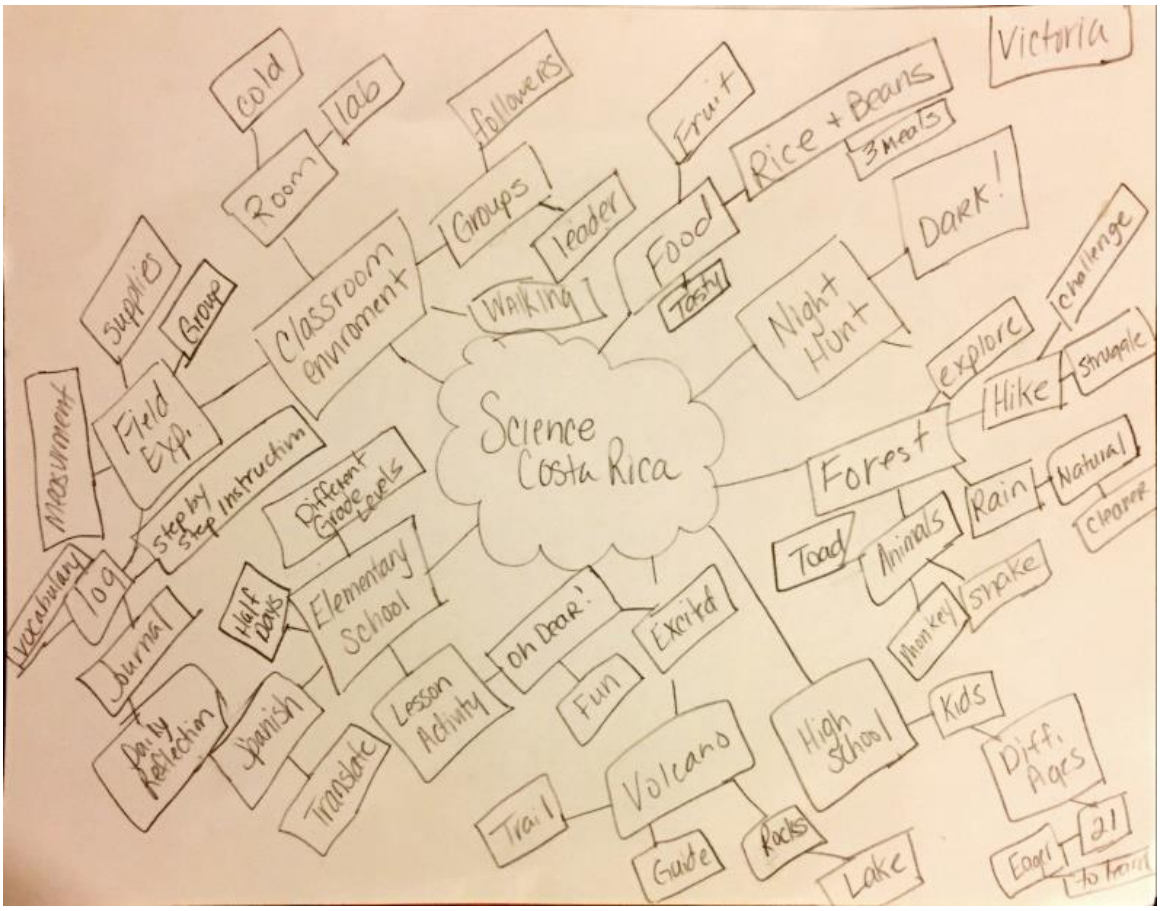

Figure 5. The front of Victoria's net-shaped concept map.

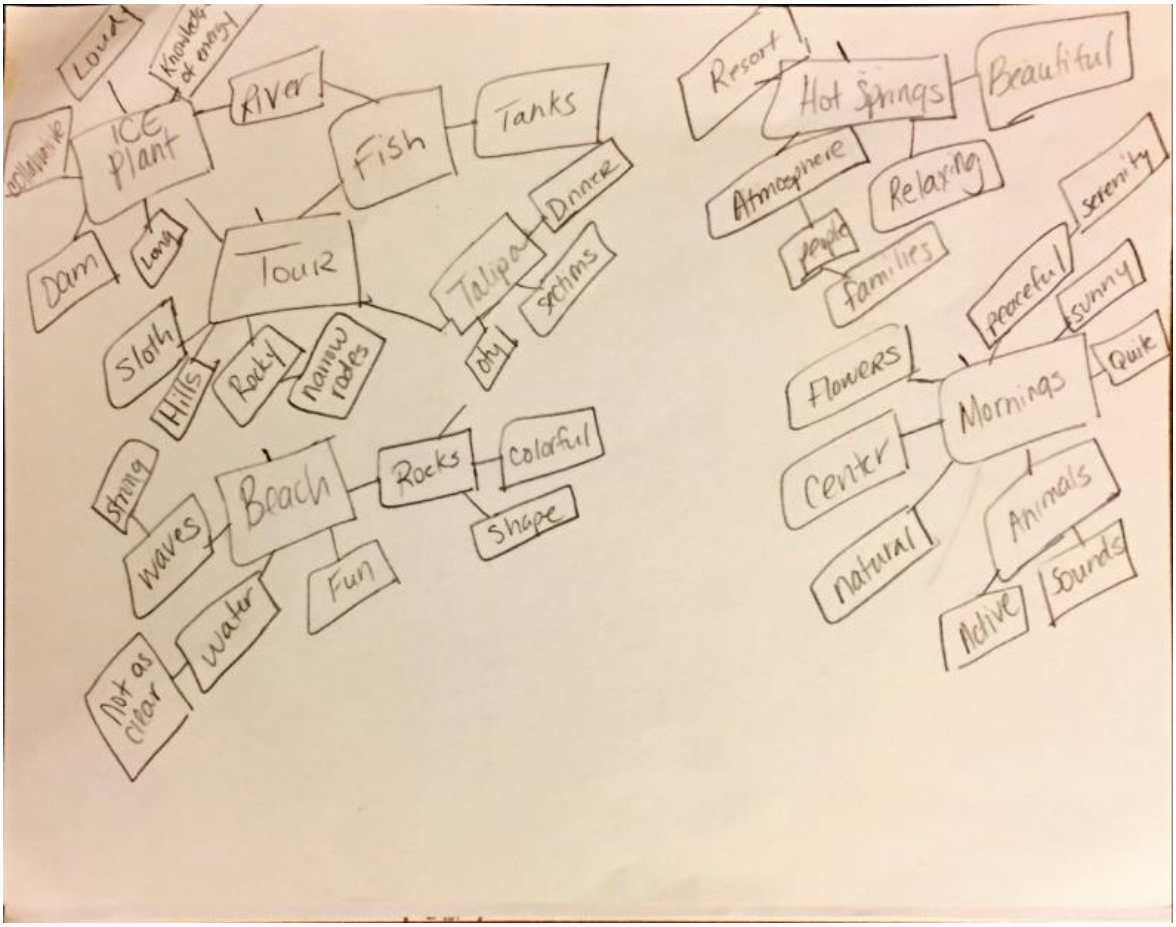

Figure 6. The back of Victoria's net-shaped concept map.

Interview

The foci of Victoria's interview were her experiences studying abroad in Costa Rica and how she used her study abroad experience in her classroom. Codes in Victoria's interview contributed to the categories: Disposition of Teaching, Pedagogical Knowledge, and Costa Rican Classroom Struggles.

During her interview, Victoria mentioned she struggled with the science content required to teach her students, especially when students ask her questions she is not able to answer. She assured, "It's challenging to make sure that you know a lot of science. This way any of the

questions that they can come up with, you can be able to answer them right. That's still a learning process for me." This topic contributed to the category, Disposition of Teaching.

In her interview, Victoria discussed the role vocabulary plays in her lessons. This excerpt from Victoria's interview contributed to the category, How You Teach. She added,

> I like to make sure they know some of those words in the beginning. And kind of focus on that and trying to really expose them to be able to explore, because they don't [have] enough background knowledge to really understand how things work or why we do what we do with them.

Victoria implemented vocabulary early in her lessons as a way to engage her students. She also used vocabulary strategies to build background knowledge.

During her interview, Victoria commented on the state of the Costa Rican classroom. Defeated, she commented, "They didn't have a lot supplies, and what they did have, it's not brand new. There was a globe that wasn't even a full globe—it was broken. The lack of books…" Victoria worked for a large school and was used to having plenty of resources and district staff support. This is an example of a part of her interview representing codes which contributed to the category, Costa Rican Classroom Struggles.

Field Notebook

As part of the class expectations, Victoria wrote in her field notebook daily for reflection. Writing prompts were about the activities of the day and how students would use their experiences in their future classrooms. Victoria's reflective journal entries contributed to the categories: Disposition of Teaching and Developing Cultural Competency.

Near the middle of the study abroad experience, students were asked to comment on their confidence in teaching science. Victoria wrote,

> I feel more confident in teaching science. I like that we get hands on experience. Being able to go into the forest, look at the plants, animals, and water falls, or streams. I know that my students will benefit from me learning more about science and being able to explore and learn with them as well.

As a result of her hands-on this experience in this class, Victoria felt more confident in her ability to learn and teach science. This is an example of interview transcript excerpts with codes which contributed to the category Disposition of Teaching. As a result of this course and study abroad component, Victoria was able to develop her self-confidence for teaching science. Victoria explained, "I felt like at that time I…I didn't have enough and wasn't exposed to a lot." Relieved, she detailed her new-found comfort in science education,

> It's made me more comfortable in science, because honestly, when I was in elementary we didn't have labs. We didn't do experiments…When I talk about those specific things, like the environment, it's easier for me to compare and help the students compare… it's easier for me to teach it because I have that background knowledge of it.

In her reflections, the important second step of Kolb's Experiential Learning Theory, Victoria described her cultural competency as limited. She wrote, "My experience with other cultures is not very wide. My personal experience with my culture is faith and family." However, near the end of the course, Victoria wrote about her ability to make accommodations for her students from other cultures. Victoria explained, "I feel that if you have a better understanding of your students, you can modify your lesson to ability levels and that will get your students interested in science." These particular journal entries contributed to the category, Developing Cultural competency.

Case 2 – Mitchell

The study abroad experience to Costa Rica was Mitchell's first trip to Costa Rica but not her first trip outside of the United States. During the data collection phase of this study, Mitchell mentioned having traveled to Temacula, Mexico, the Yucatan Peninsula, and Paris, France. While Mitchell had traveled abroad before, this was her first experience studying abroad.

Mitchell was enrolled in the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers, as a graduate student. During the study abroad experience, Mitchell was a preservice teacher working on a master degree in secondary education. She was also a member of the Masters and Alternative Certification (MAC) program. Mitchell also holds an undergraduate degree in Chemistry.

Mitchell is a certified classroom teacher. She holds a teacher certificate in Physical Science for grades 8 - 12. She has been the teacher of record in her classroom for five years. Mitchell teaches at a high school in a district, which has approximately 4,000 students. The school district that Mitchell works for operates on a year-round school year calendar. Additionally, Mitchell had three study abroad students in her classroom--one student from each of the following three countries: Korea, Belgium, and the Czech Republic.

Concept Map

Mitchell's role in this study as a participant began with the construction of her concept map (Figure 7). She crafted her concept map as she recalled the events of her study abroad experience in Costa Rica. Mitchell revisited her concept map during interview. The codes from these excerpts of Mitchell's concept map contributed to the categories Developing Cultural Competency, Pedagogical Knowledge, and Foreground of Costa Rica.

In Mitchell's concept map, she remembered understanding about students from different backgrounds. She expanded on the node, "Informal Meeting," and these coded sections contributed to the category, Developing Cultural Competency. Remarkably she explained,

> I will say I definitely have a different perspective about kids coming from other countries. I currently have a student who is from Puerto Rico and I've been to Puerto Rico. Just sometimes just talking to him about some of the places that he knows and that I've been to, that kind of makes a connection.

As Mitchell made a personal connection with a student from a cultural background different from her own, she was able to establish a respectful rapport with the student, and moreover made a connection with the student.

In her concept map, Mitchell wrote about integrating science equipment into classroom instruction. Integration of science equipment into science classroom instruction meets Kolb's fourth stage of the Experiential Learning Theory, active experimentation. This comment was linked to the node informal meeting, as this was information she acquired during down time at the research center. Excitedly in her interview, she remarked, "I guess that's a moment I really liked about the class—that it was so hands on. It was getting teachers who don't necessarily like science to actually do science for the benefit of their kids." This was especially important to Mitchell as she is a high school science teacher. For herself and other teachers, this part of the concept map contributed to the category, Pedagogical Knowledge.

A self-proclaimed "snake and bug person," Mitchell expanded on her "Hiking," node with the comments "poison dart frog," "lots of snakes," and "huge insects." Mitchell's attention to the inhabitants of her surroundings contributed to the category, Foreground of Costa Rica. In

her interview, she revisited her favorite moment happily, “Seeing all those cool snakes and bugs was pretty cool—especially the poison dart frog. I was so excited when I saw it.”

The following figure is the concept map Mitchell created to describe her study abroad science experiences. This concept map helped her describe connections between her study abroad experience and her classroom experience.

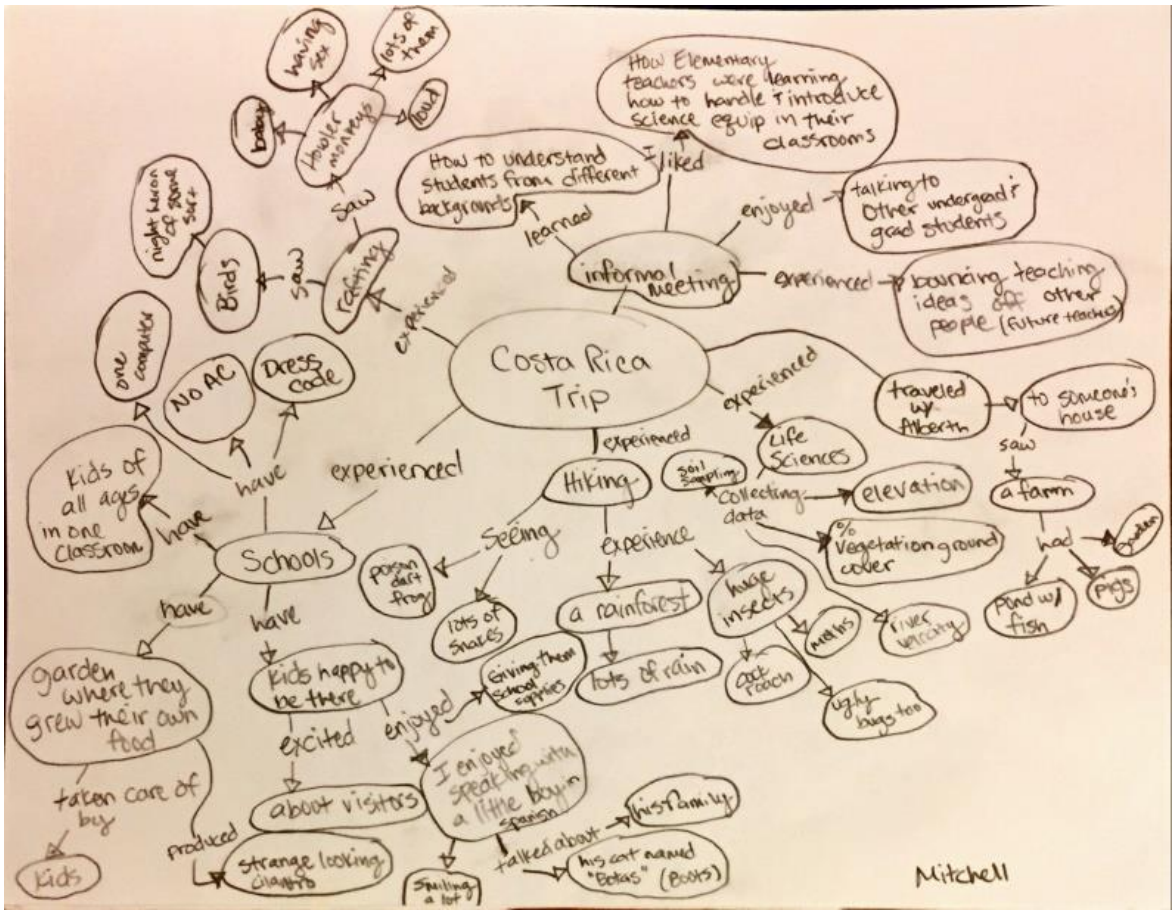

Figure 7. Mitchell’s net-shaped concept map.

Interview

After Mitchell constructed her concept map, I interviewed her about her experiences in Costa Rica. We also discussed her classroom practices. Mitchell revisited her concept map as

we conversed about the events of the study abroad experience. Codes from Mitchell's interview contributed to the categories Disposition of Teaching, Facilitated Science Experiences, and Positive Costa Rican Classroom Climate.

During her interview, Mitchell seemed to have a positive attitude towards science and high confidence in science. Proudly she explained, "I've pretty much grown up with science. My mom's a biologist. I've always grown up with science. My dad is an avid hunter—biology has always been part of me." Due to these factors, Mitchell seemed to have a high self-confidence in science. As a result, this excerpt from Mitchell's interview contributed to the theme, Disposition of Teaching.

Mitchell's interview also contributed codes to the category, Facilitated Science Experiences. In her interview, she recalled field science activities. She recollected,

> We did the elevation [profile] and percent vegetation ground cover. I remember that one specifically because I've done that at the National Wildlife Refuge. I remember doing that there. And didn't we look at plants at different elevations?

During her interview, Mitchell also mentioned her other experiences collecting data in the field. She mentioned collecting data during a major hurricane, collecting diurnal data, and making animal observations in the field.

During Mitchell's interview, we revisited the Costa Rican classrooms where the participants spent time making observations. Proudly, Mitchell remarked at the school's efforts to keep a campus garden, she said "They would grow their own food and make it for the kids. The kids seemed to really enjoy the garden. They were definitely happy to show what they were

growing." This excerpt from Mitchell's interview contributed codes to the category, Positive Costa Rican Classroom Climate.

Field Notebook

During the study abroad experience, Mitchell wrote her reflective journals daily. Her topics ranged from field science methods to multicultural instructional methods. Her field notebook contributed codes to the following categories:

In one writing prompt, students were asked to describe the differences between the beach in Costa Rica and the beach near their home university. As Mitchell noted the differences between the two beaches, she decidedly wrote, "I will use this knowledge to bring back to my students and talk about where sand comes from and how it influences the environment." Planning on integrating study abroad experiences into science curriculum demonstrated Kolb's third phase of the Experiential Learning Theory, abstract conceptualization. This excerpt from Mitchell's field notebook contributed to category, Background of Costa Rica.

In a later reflective journal entry prompt, students were to discuss how to support students from other cultures. Mitchell wrote about culturally-responsive instructional methods she planned to incorporate in her classroom. She wrote, "I will also use groups and pair share to allow my ELLs to speak without being put on the spot. I also want my students to feel free to discuss their experience with the class." This plan for instruction contributed codes to the category, Transferability of Instructional Approaches.

Evidence from concept maps, interviews, and field notebooks were analyzed and contributed numerous codes which were grouped into the categories: Facilitated Science Experiences, Collaborative Grouping, Background of Costa Rica, Foreground of Costa Rica,

Atmosphere of Costa Rica, Disposition of Teaching, Pedagogical Knowledge, For Whom You Teach, Costa Rican Classroom Struggles, Positive Costa Rican Classroom Environment, Transferability of Instructional Approaches, and Developing Cultural Competency. These categories also contributed to the four themes presented in this study. They are discussed in the cross-case analysis which follows the case reports.

Cross-case Analysis

The categories found in Victoria's and Mitchell's data analysis resulted in four themes: experiencing science in Costa Rica, studying abroad in Costa Rica, transferability of science experiences, and the multicultural classroom. These are described in the following cross-case analysis.

Experiencing Science in Costa Rica

The first theme, experiencing science in Costa Rica, was comprised of the categories facilitated science experiences, collaborative grouping, and science stressors. During interviews, both participants discussed the integrated science activities during the study abroad experience. When asked if she experienced any epiphanies during the duration of the study abroad course, Victoria commented, "I don't think it was just one thing, it was a lot of little things that made you open up your eyes to different learning experiences." While Victoria's response was more perfunctory in nature, Mitchell listed the aspects of science inquiry she enjoyed while in Costa Rica. She stated,

> I had a lot of fun looking for different species of animals, collecting scientific data, and just being out there in the rainforest. The animals we encountered were very different from those we are used to here in the U.S. As a science teacher I appreciate the fact that there was a lot of science was incorporated into our daily activities.

Participants were exposed to nature daily while at the research center, during a guided hikes or faculty-led science activities in the forest, and while on excursions in Costa Rica. Field science activities in Costa Rica provided the first phase of Kolb's Experiential Learning Theory, concrete experience.

Facilitated Science Experiences

During the study abroad course, students engaged in field science activities in the forest around the research center Monday through Friday during both weeks of the class, and participated in science-focused excursions on the weekends. The field science activities opened with in-class, pre-lab instruction and closed with a post-lab debriefing. Each field science activity required a trek up the foothills around the research center to explore the different ecosystems required for each activity. Since field science activities were conducted in the afternoon, data collection was sometimes held up by rain delays. Victoria recalled, "We were able to explore the different environments. It rained a lot. Everything was wet. It affected the animals that were there because when it rains a lot, the animals wouldn't come out so much."

The purpose of the field science activities was two-fold: to increase science knowledge and to provide background knowledge in order to address a problem-based field science task at the end of the course. The instructional methods and science content provided to the participants was modeled after field science methods employed by geographers. Mitchell compared the study abroad field science activity and her prior experience collecting data in the field, "We did the elevation stuff and percent vegetation ground cover. I remember that one specifically because I remember doing that at the National Wildlife Refuge." Mitchell is noting the similarity of the field science activity as it relates to data collection in real-world science practices.

Collaborative Grouping

During the study abroad experience, field science activities were completed in small groups. Student groups were a mix of doctoral, master, and undergraduate students. Students had varied experiences in science and the grade school classroom. Mitchell's group consisted of three master students with strong science backgrounds, and one undergraduate student. Victoria's group consisted of one doctoral student with a strong science background, and three undergraduate students. Victoria remarked,

> I think it was a little different [be]cause with our groups that we had, some of us had a lot of experience and knowledge about science, and I felt, at that time I didn't have enough and wasn't exposed to a lot. So, all the new things I was learning—it was nice to see a different perspective of somebody that actually maybe had taught or knew it.

Students also spent time together after dinner—convening on a bungalow deck or in the air-conditioned classroom after receiving journal entry topics. Mitchell remembered, "The informal meetings that we had just about every night were nice too. We had journal entries to write about, we would talk about that day's adventure, and we would discuss what we learned about." Most of the students' journal entry topics revolved around the day's events during school observations and time in the field, and asked the students to think about how they would incorporate their science experiences in their future classrooms. Reflective journal entries were considered homework, and part of the students' course grades.

Science Stressors

The category, Science Stressors, was formed by codes that can be described as the aspects of science that are less manageable for students enrolled in a field science course. Some students may have struggled with traveling abroad for the first time, visiting Costa Rica for the

first time, or with the Spanish-language barrier. Science, unlike other content areas, requires an additional skill-base just for lab and field instrumentation. Victoria commented that she struggled with the science during the course of the class, "It was a little overwhelming with a lot of the different science terminology and measuring things and using tools you've never had to use." In addition to instrumentation, science also is framed by many vocabulary terms. Regarding science vocabulary, Victoria commented,

> It can be challenging because when we joined [in at] the elementary school during science, many of the terms I did not know. I could not teach the subject. It's just because of that unfamiliarity that you had with it, that made it a little more stressful.

Victoria described her lack of science knowledge and how it made her feel when it came time to demonstrate the knowledge required to instruct students in the classroom.

The area in which the research center was constructed was very rural, densely vegetated, and filled with unfamiliar animals, large and small. The environment in Costa Rica was different from the environment in the southwest United States. In her concept map reflection, Victoria referenced the forest wildlife which bordered the research center. She recalled,

> The night hunt was very interesting and yet frightening. I was really terrified that a huge snake would fall on me a squeeze me to death. Did I mention that I do not like any kind of bugs or insects and especially snakes?

For some students, this may have been the first time in their lives they experienced the outdoors in such a highly-saturated manner.

In her interview and reflective journals, Mitchell explained her family's science and outdoor influence on her childhood and the numerous field experiences she participated in during her time in college. While the science content and experiences were not taxing on Mitchell, she

discussed the time commitment of participating in the class. "The research paper, I hated the timing and everything that went on with that, morning and night, and all those hours out." Mitchell explained that the daily schedule was jam-packed with activities and that it was a challenge to complete the science writing assignments, including a journal manuscript and reflective journal entries that the course required.

Studying Abroad in Costa Rica

The second theme, studying abroad in Costa Rica, contained the categories Costa Rica is your oyster, background of Costa Rica, foreground of Costa Rica, atmosphere of Costa Rica, and Costa Rican culture. The purpose of the study abroad course was to provide students with science experiences and multicultural instructional strategies with the intention of applying these experiences in future classrooms. Costa Rica provided the setting of the study abroad experience because of its unique environment and cultural practices different from our own in the United States. The participants' university did not include study abroad as a student requirement. Victoria shared her feelings about studying abroad in her concept map reflection,

> Traveling was not something I had planned on during my college experience but my Costa Rica study abroad program was [definitely] educational and memorable. It is simply beautiful and uplifting to experience what nature has created. Costa Rica is completely a beautiful place. I look forward to going back and exploring more of the culture. PURA VIDA!

Pura vida is a greeting of endearment in Costa Rica. Its meaning is multi-fold similar to Hawaii's, "Aloha." In essence, it means: to enjoy the little things with a calm lifestyle.

Since the nature of the course included classroom, science, and cultural components and the itinerary was constructed in a way to maximize exposure to Costa Rica, student reflective journal played a key role in capturing the essence of these experiences. In her interview, Mitchell revisited the purpose of her journal,

> I know we had our journals. I'd have to say I enjoyed the journaling part of it. That was nice to just go back and reflect on my day, even now when I probably forgot a lot of this stuff, I can always go back, and reread over that stuff.

Not only did the student journal serve the purpose of providing a snapshot of the day's activities, but students are able to look back to recall memories made.

Costa Rica is Your Oyster

One difference in Costa Rica, when compared to the students' home state, is the presence of volcanoes. During an excursion to the active volcano, Mount Arenal, the students, guided by the research center director, hiked the trails around the volcano. During her interview, Victoria recalls her experience,

> It's just like when we went to the volcano. We've never experienced anything like that here and so, that was just…it was just so amazing. What was right in front of me and what I was seeing, what I was experiencing at that time—where are we going to get that around here?

Mitchell also mentioned the uniqueness of Costa Rica. She said, "I think it was that fact that you had an opportunity to see different things. You're not just going to see a Texas rattlesnake from the side of a road." Besides the volcano, the students experienced other sites and animals not found in their home state: a rainforest, a waterfall, a cloud forest, crocodiles, and monkeys—to name a few.

Background of Costa Rica

The research center borders the Children's Eternal Rainforest, Costa Rica's largest, private reserve. The Children's Eternal Rainforest boasts 54,000 acres of primary and secondary rainforest—equivalent to the land which makes up Seattle, Washington. A forest of that size has the potential to provide many opportunities for visitors. Victoria explained, "It was so enormous. We seem like itty bitty people in this enormous forest of beautiful, natural environment." While the participants did not tour the entire reserve, their average hike was approximately one-mile with an elevation of 1900 feet at its highest point.

Away from the reserve, Jaco Beach can be found on west coast of Costa Rica where the land meets the Pacific Ocean. After the first week abroad, participants spent a Saturday afternoon at Jaco Beach after a four-hour road trip. The city the participants live in is bordered by large bodies of water. The Gulf of Mexico sustains two large bays and a lagoon. Both participants mentioned the differences in beaches in their concept maps, interviews, and reflective journals. Victoria notes,

> The beach—it was different. It wasn't as clear as I thought; but, maybe it had to do with where we were or where the beach was. There is no sand, but plenty of rocks. [In our city] you will find shells, but not on Jaco.

Additionally, Mitchell compared the waves on the two bodies of water,

> The black gravel stood out the most to me. The waves were also much larger than our hurricane-sized waves back in Corpus Christi. Our sand is also a light tan color and is finer than that of Costa Rica's Jaco Beach.

The rocks and black gravel the participants described is composed of eroded volcanic rock. The volcanic rock is produced from eruptions during sea-floor spreading or from lava which makes its way from land to the sea.

Foreground of Costa Rica

Costa Rica is also unique in that, while it is a small country, it has a high level of biodiversity—meaning a variety of living organisms. Living organisms range from bacteria to animals; and, it was the animal group which made an impact on the participants. Victoria reported, "The crocodiles…now that was just amazing. How much water…and how huge the animals were. I mean they were just…it's beyond me. That was a very, very good experience." Victoria referenced a stop on the way to Jaco Beach at Rio Tarcoles. The bridge occurs over a natural habitat of a population of American Crocodiles where many tourists stop to take pictures. The crocodiles can be seen basking and swimming along the river.

Animals were apparent at most, if not all, field science activities and excursions during the study abroad experience. Some participants became fascinated with a particular animal while others where always on the lookout for any animal after becoming familiar with where to find certain animals. A small group of participants went as far as to give names to the animals they would identify.

> I remember seeing all the really cool animals. I'm a snake and bug kind of person so, seeing all those cool snakes and bugs and everything was pretty cool—especially the poison dart frog. I enjoyed everything—everything about it, the rafting trip, and seeing those monkeys. I think that was the first time I've seen monkeys outside of the zoo.

Most participants in the study abroad course observed a poison dart frog in the forest as its vibrant colors contrasted against the dark, wet leaf litter of the forest floor. In her interview,

Mitchell also described disappointment about a missed opportunity to witness an eyelash pit viper basking near the hiking trail.

Atmosphere of Costa Rica

Both participants remarked at the ambiance of Costa Rica. Participants described the climate and weather as humid and rainy and the forest—busy with activity—as calming and beautiful.

> The sounds of the rain…I mean, we wore ponchos all the time, so either the rain hitting you, or the animals. Sometimes it was real aggressive sounds [or] it seemed like there were others trying to be dominant, or just that [the animals] were happy—the chirping, the birds…just real peaceful and joyful.

Every day studying abroad brought on high humidity in the morning and showers in the afternoon and into the night. There was never a time the forest wasn't active with sound, but it was especially productive in the morning.

Costa Rican Culture

When the participants first visited the Costa Rican schools, they were given a tour of the grounds of each school. One commonality among the campuses was they all had space to play soccer. Victoria remembered,

> Of course, the soccer field…There's always a soccer field in front of something. Whether it just a little post—knowing that… that's the goal, or a good area to just play. Honestly, many of the places we visited had somewhere to play soccer.

Among the other places we visited, the Tilapia Farm had the best developed soccer field. It was equipped with stadium lighting and full-fledged soccer goals. Even though it was raining, there

was still a game going on. Most tourist hubs also sold commemorative Costa Rican national soccer team jerseys.

When the study abroad group landed at the airport in San Juan, there was a large group of individuals with surfboards. When visiting Jaco Beach, observing the large waves made sense of the high numbers of surfers landing in San Juan. Victoria described her time on the beach, "It was wonderful experiencing Jaco Beach today. I was very impressed with the waves. Surfers took advantage of the beautiful waves. The strength of the waves made some beach goers fall." Jaco Beach hosts many surfers as well as is part of national and international surfing circuits.

One positive aspect of the study abroad stay at the research center was the quality of meals provided to the guests. Victoria bragged about the meals at the center, "The food was amazing. I enjoyed eating the black beans for every meal. The fruit was delicious and different from what I'm accustomed to eating." The meals provided by the cafeteria staff at the research center were traditional Costa Rican dishes. All breakfasts included a meat dish with fruit, white rice, and black beans. All lunches and dinners included a meat dish with salad, white rice, and black beans. When the white rice and black beans were combined together with onions, cilantro, and peppers, it fashioned the Costa Rican staple, *gallo pinto.*

Transferability of Science Experiences

The third theme, transferability of science experiences, included the categories disposition of teaching, pedagogical knowledge, what you teach, and for whom you teach. The purpose of the study abroad course, Environmental Science and Multicultural Experience for K – 8 Teachers was to increase science experiences and multicultural strategies to be applied in the classroom. Students participated in daily field science activities and excursions, as well as made observations in Costa Rican schools. Field science activities began with pre-lab instruction,

including pertinent vocabulary, in the research center classroom before moving to the field for the science exercise. After the field science activity was completed, students and faculty met back in the classroom for post-lab debriefing. Near the end of the course, students had accumulated a skill set which would aid them to address a problem-based learning task for their final exam. Daily reflection prompts suggested students discuss classroom applications. During her interview, Victoria commented, "We were measuring hills and doing stuff like that. There's other ways you can do that here; but they have to know how to measure and know conversions and things like that." Victoria expanded in other sources of data about the importance of knowing how to use measuring equipment in science tasks, both for her and for her students. Mitchell previously mentioned the importance of meeting informally in groups at the end of the day during reflection. She added, "I thought it was a great opportunity to talk to other graduate and undergraduate students and discuss how we would use this information in our own classroom." Mitchell's statement recognizes the purpose of the study abroad course—to include science skills in classroom applications. Planning to integrate applications from the study abroad field science activities achieved Experiential Learning Theory phase three, abstract conceptualization.

Disposition of Teaching

In her interview, Mitchell described her background in science from the time it began to develop during childhood until her experiences in college. Science plays a significant role in her life and career, and as a result drives her interest in science. In her reflective journal, Mitchell asserts her curiosity,

> From today's experience of the cloud forest, I am most interested in the use of all this water by humans. From an experience in Tulum, Mexico, collecting rain water to use for

> showers was a must. There was really not a hot water heater, just the sun. I'm interested in finding out if Costa Ricans use their rainfall in a similar way, other than for energy.

During one excursion, the study abroad group visited I.C.E. Hydroelectric Plant where running water turns turbines to generate electricity for the nearby village—part of the country's efforts to build energy-efficient communities. Additionally, there is an aquaculture center on-site which carries out research on local species of freshwater fish.

In her interview, Victoria disclosed she did not feel confident in science because she lacked meaningful experiences in science during her schooling. Additionally, she admitted sometimes she finds students' questions challenging to answer. As a result of the study abroad course, she states

> It has broadened my science, to where I'm more interested in learning how things work and why things are the way they are. Just like the kids. Sometimes they teach me stuff, with what they know because of their experiences, because their background knowledge. I think it has made a huge impact on me, and I try to share those experiences with my students. I have frequently talked about the animals and the environment and how different it is.

This study abroad course supplemented her science experiences and thereby provided her with science experiences, which built up her confidence in the science classroom. Specifically, she notes the types of experiences she attributes this shift in science interest. She clarifies, "I feel more confident in science. I like that we got hands on experience—being able to go into the forest [to] look at the plants, animals, and waterfalls, or streams." The experiences in the field are student-centered and hands-on, which she claims aided learning science from an in-context approach—experiencing the forest first hand.

During her interview, Mitchell was asked if she experienced any epiphanies during the study abroad course. She explained what hit home with her the most,

> At the end I remember some elementary school teacher talking about how they're not so afraid of science anymore and I *really* liked that. That was something that was important to me because, being a high school teacher, I want my kids to understand the scientific process before they get to my class rather than just know it by heart. I guess that's a moment I really liked about the class and that it was so hands on. It was getting teachers who don't necessarily like science to actually do science for the benefit of their kids.

Mitchell goes on to explain the study abroad course helped some preservice teachers overcome their fear of science. Encouraging the preservice teachers take a hands-on approach to their field experiences inspired the confidence which could translate into student confidence in elementary science and, hopefully, follow them through to their secondary science courses. When questioned if she experienced any shifts in science confidence, she reported, "I can't tell. I can't really tell because I feel like I've had so much science, that I think it would be easier for somebody who didn't have science background and did it." Mitchell was unable to identify any shift or growth in her attitude towards science. Victoria and Mitchell had different backgrounds in science; and, thus, had different levels of self-confidence in science.

Pedagogical Knowledge

In her reflective journal, Mitchell discussed her approach to making science interesting to students. She wrote, "I believe that science is started by the questioning the world around them. I also believe in making science fun through posing questions and finding out the best way to answer them." Mitchell's approach to science instruction is to engage her students by sparking

their interest in science. Conversely, Victoria engages her students by focusing on vocabulary at the beginning of a new unit in her classroom. In her interview she presented,

> Vocabulary is very important. I like to make sure they know some of those words in the beginning and focus on that, and try to really expose them—to be able to explore. They don't [have] enough background knowledge to really understand how things work, or why we do what we do with them.

By covering vocabulary with her students, she provides background knowledge about the upcoming topic in her class.

In her reflective journal, Mitchell describes the resources she plans to use in her classroom. She describes, "Many of our students and teachers don't realize the awesomeness of our "backyard." When I have my own classroom, I want to show my students how much we have here." Mitchell sees an opportunity to scaffold her students' science experiences by including field science instructional strategies in her science classroom.

Most recently, when asked to describe how she uses what she learned in Costa Rica in her instruction, Victoria replied,

> I see the experiences that I had, as far as having students work in groups and talk[ing] to each other—giving them that exposure. We did it as well over there. I could see that we learn better from each other, so I try to give them more of that experience.

Victoria chose to employ purposeful student grouping as a resource for her students because she feels it worked well for her group while studying abroad in Costa Rica.

Previously in her interview, Mitchell described the challenges negotiating a jam-packed itinerary with the independent work demands of the course. She explained while it was difficult to manage time abroad she also admitted,

> I think that was important. Especially since I think science writing is definitely different that other types of writing; and so, for other people to see that—specifically other teachers that are non-science background—to see that, I think is important. It's important for them to translate that to their kids because in my AP Physics class, they do write lab reports. Sometimes it's a struggle.

Science writing plays a significant role in the science classroom especially towards the end of lesson when it is the responsibility of the student to communicate the results of an activity or lab. Mitchell expresses the importance of teachers understanding how to write scientifically for themselves and for their students, as writing lab reports is something, which follows a student throughout grade school.

The faculty's approach to science instruction was not only student-centered but also included math integration. In her reflective journal, Victoria revealed, "I am excited to teach my students different ways to learn science and incorporate other subjects as well." During the course students collected field data which reflected skills in math including measuring distance and elevation, tree height and diameter, water discharge, and a nocturnal animal survey. Additionally, Mitchell incorporates math and technology integration to her science lessons in her classroom. In her interview, she talked about her efforts to integrate math and technology in the science classroom. In reference to using technology apps on smartphones in the science classroom, she mentions,

> Coordinates and all kinds of stuff...There's also some where you put where you are—and let's say you want the area of a square—put a mark here, walk, put a mark here, and then it will actually get the area. It's pretty cool.

Mitchell further discusses other technology apps for smartphones she uses in her science class.

What You Teach

Mitchell recalled a Geographic Information Systems (GIS) class she taught at her campus. Students would use a smartphone app when she taught satellite triangulation.

> I did one in the parking lot—around our school—where they had to choose a point, get the coordinates for that point, and then they did triangulation. So, we did three different spots. That's the way satellites find your specific location.

Mitchell went on to compare it to the orienteering lesson the study abroad students completed in the forest around the research center during her study abroad experience. Conversely, the students in the study abroad course used traditional, hand-held compasses.

During her interview, Victoria described how she uses what she learned in Costa Rica in her science classroom. She detailed,

> When I talk about specific things, like the environment, it's easier for me to compare and help the students compare, that way I bring in what I've experienced and maybe even show pictures. It's easier for me to teach it because I have that background knowledge of it.

Victoria uses her experiences, and her photographs from Costa Rica, during teachable moments when she covers environments in her science instruction.

In their reflective journals, both participants considered how they could use their experience at Jaco Beach in their classrooms. Victoria envisioned,

> I can take this back to the classroom by showing them pictures [and] having [them] share their experiences at the beach—a writing prompt, or similarities and differences. I collected a few rocks maybe they can identify features of the rocks.

Similar to a previous statement, Victoria could use this classroom application when discussing environments in her science instruction. On the other hand, at the secondary level, Mitchell described how she would use her beach experience for her science instruction. She wrote, "I will use this knowledge to bring back to my students and talk about where sand comes from, and how it influences the environment." Mitchell planned on having students explore the role sand plays in the environment.

For Whom You Teach

The ultimate goal of the study abroad course for the students/preservice teachers, was to relay their science experiences in Costa Rica to the students in their future science classrooms. For Victoria, her hopes for her students include the following sentiment, "I want to share those experiences so they can get excited, maybe one day want to visit somewhere else so they can have those experiences as well." Victoria hopes to pass on her excitement from studying abroad in Costa Rica to her students. She seeks to inspire her students to travel abroad to have their own experiences. As for science in her classroom, Victoria stated, "I know that my students will benefit from me learning more about science and being able to explore and learn with them as well." Victoria described her confidence in her ability to serve students in science as a result of her study abroad experience in Costa Rica.

In her reflective journal, Mitchell takes a more specific approach to a science topic in her class as she reviewed her trip to the hydroelectric plant. She wrote,

> This relates to my classroom because water is an important resource that we take for granted. This is "real science" because it is an important issue that we need to address as Texans. The water coming from our faucets probably traveled a long way to get to our sinks. We need to teach conservation.

Mitchell's approach to incorporate a real-world science concern in her curriculum and instruction is a reflection of her effort to build her students' understanding of the nature of science—a way of knowing science, beyond simple recall of science content.

The Multicultural Classroom

The fourth theme, the multicultural classroom, was made up of the categories Costa Rican classroom struggles, positive Costa Rican classroom climate, transferability of instructional approaches, and developing cultural competency. Each weekday during the study abroad course, students visited the Costa Rican schools in the vicinity of the research center. The purpose of their visits was to observe students of a culture different from their own culture. As the preservice teachers became more familiar with the students, their time engaging with the students became more meaningful. During her interview, Victoria gave an overview of the environmental education activity Oh Deer,

> It actually helped us because we were going in there as a group. It bonded us together as the teacher and the students—them seeing us as teachers and them actually learning a little bit. They had a lot of fun and at that time, a lot of kids were eager to talk to us. If we asked them questions before, they were shy and not as responsive; but, then after that, it kind of broke the ice.

Victoria's description of the interaction between the university students and the Costa Rican students describes a moment where teachers and students from two different cultures come together for science.

The Oh Deer activity was an outdoor education game played with the whole class. The purpose of the Oh Deer activity was to convey the biological concept of carrying capacity. Carrying capacity is the idea that there are only so many resources available to a population of

animals in a given area. To begin the game, the whole class was divided into two even groups. Each group of students moved to either end of the playing area. The two groups of students faced the edge of the playing area so the two groups of students were situated back-to-back in the playing area. Next, each student placed their hands and arms in a position which indicated what type of resource they were looking for—the choices included food (hands over abdomen), water (hands over mouth), or shelter (hands over head in a point). Then, the two groups of students turned face-to-face. The goal for each student was to match up with another student with the same resource from the opposing side. Any student, from either side, who did not match up with another student from the opposing side, was out of the game. Biologically speaking, any animal without adequate food, water, and shelter, would leave the area to find the resources they require. The Oh Deer game continued in the same fashion until all students were out—or rather, until each animal was out of resources.

Costa Rican Classroom Struggles

One commonality between both participants, across all data sources, was the recognition of the status of the Costa Rican classrooms. Victoria describes the lack of classroom resources,

> As soon as you walked in, it was just one room. You saw several desks in groups, but they were all different levels. It's not like it was a fourth grade classroom. It was maybe some seven year olds, ten year olds. The classroom was very plain. It was definitely…they didn't have a lot supplies, and what they did have, it's not brand new. There was a globe that wasn't even a full globe—it was all broken …the lack of books. I believe there was a chalk board that they wrote on.

Beyond the status of the classroom, Mitchell also recognized the teacher was stretched to her limits to address the needs of all of her students.

> I remember the teacher going over something; but, some kids were listening and some kids were doing their own thing because they had different age groups in there. I noticed that the teacher used mainly workbooks and some worksheets as her method. I also noticed that one classroom could have as many as four different grade levels being taught by one teacher. I'm assuming that this is one major reason why the students usually work independently in their workbooks.

That is not to say the Costa Rican classroom was complete chaos or the teacher was ineffective. The teacher's practices were both similar and different to what the preservice teachers expected to see. Victoria noted the similarity and difference in her reflective journal, "Students would listen to lectures and take notes. Our students take notes but we have more hands on experiences." This would not be the only student differences Victoria would note.

During one classroom observation, the study abroad students were invited to the high school which neighbored the elementary school they spent most of their time. "It was a different culture for students because their family does not allow some [children] to attend school because they have to work. Students were different ages and had a few over the age of 18." Victoria noted the difference between American and Costa Rican students as it related to compulsory school attendance.

In her discussion with the Costa Rican classroom teacher, Mitchell gathered the following facts. She considered this information in her journal reflection. She wrote, "Costa Rican schools get very little financial support from the government. Instead, the students must rely on their parents' money, scholarships, and fundraisers to keep the school afloat." Mitchell further compared the Costa Rican financial dependence to that of the U.S., where taxes and government funding support educational needs.

Positive Costa Rican Classroom Climate

While the study abroad students were aware of the stresses of the Costa Rican classroom, they were equally captivated by the successes at the Costa Rican school. Again, this recognition was apparent between both participants and across all data sources. Victoria commented,

> The students seemed to be so happy and eager to be in school—to be amongst friends, and the interaction with the teacher. The students weren't loud, they were calm. The teacher would give instruction—and the students would be very eager to answer—and even have a little bit of higher order questioning. It was real interesting to see. Even some of the older kids helped the younger kids—learn from each other. That was really interesting.

Mitchell noticed the positive atmosphere as well. She further compared the student attitudes in Costa Rica to their American counterparts. In her interview she hinted, "Costa Rican kids seem like they want to be in school to learn. Kids from the U.S. seem to have more of a negative view about attending school." Mitchell's opinion is informed by her own experiences in her classroom.

Despite not having many resources on campus, the Costa Rican elementary school students were ecstatic to show-off their garden to the visitors. In her interview, Mitchell fondly remembers, "They would grow their own food and make it for the kids. The kids seemed to really enjoy the garden. They were definitely happy to show what they were growing." As Mitchell detailed, not only was growing food a learning experience for the students; but, the produce was also a resource for the cafeteria as it was used to supplement the meals prepared by the staff.

Transferability of Instructional Approaches

Similar to the science goals for the study abroad course, another course objective was in place. It was the hope that the study abroad students would apply their multicultural lessons from abroad in their future classrooms thereby achieving Experiential Learning Theory phase four—active experimentation. Like some multicultural concerns in the American classroom, the issue of language barrier became apparent. During her interview, Victoria discussed the outcome of the Oh Deer activity. She said,

> We did an activity with them. It was pretty much the whole group; and, even though there was somewhat of a language barrier, they responded very well, they understood what the concept was, they picked it up, and they loved it.

As in the American classroom, when a language barrier exists, the teachers modify their lessons and the students adapt during participation. Teachers modified their lesson by including nonverbal cues for the students who were monolingual Spanish speakers. One faculty member traveled with the group as an observer and who was a Spanish speaker, supervised the activity.

During the debriefing multicultural seminar which occurred each time after the Costa Rican classroom observations, the study abroad students were introduced to culturally sensitive teaching strategies via whole-group instruction. Students also broke out in small groups to talk about the multicultural strategies applicability in the K-12 classroom. Many of these strategies were included in both participants' reflective journals. Victoria described her plans for implementation,

> When reading the textbook, there were a few new strategies I would like to try like modeled talk, and imaging to begin with. I would like to know what works for my students. I would make sure that the students are able to comprehend the lesson and if

> not, modify it or reteach it. The students would have to have visuals and other resources to acquire background knowledge.

Victoria was able to identify multicultural strategies new to her, for use in her classroom. She also made a connection between the multicultural strategies and the Oh Deer lesson the she and the other study abroad students carried out. In her reflective journal, she wrote, "A perfect example is the Project Wild lesson we did. [It] is a great example of [a] connection with students by using these strategies. You can easily read a story with science related information and retell a story." The Oh Deer activity is about the ecosystem resources available to deer in their habitat. Victoria suggests including a cross-curricular connection by including a related story.

As Victoria was currently a classroom teacher she described approaches she takes to aid students with different backgrounds. In her interview, she stated, "When I have had students that do not speak English, I make sure the instructions are in English and then in Spanish, but I work with the student. A buddy can be assigned to that student for additional help." Employing the help of a classroom helper may make the task at hand less overwhelming for students who may be, for example, English language learners (ELLs). Mitchell uses a similar method in her classroom. In her reflective journal, she mused,

> Participating in this class has influenced [my] approach. I can see ways to incorporate math into my lessons when considering students (ELL). I will definitely incorporate more vocabulary into my lessons. I will also use groups and pair-share to allow my ELLs to speak without being put on the spot. I also want my students to feel free to discuss their experiences with the class. I want students to be able to reflect too!

Not only does Mitchell seek applications for the multicultural strategies she acquired while studying abroad, she also reinforces the use of reflection in her classroom.

Developing Cultural Competency

Beyond classroom applications of culturally sensitive strategies, the objectives of the study abroad course sought out to develop culturally sensitive individuals. This meaning someone who recognizes, adapts to, and includes other from cultural backgrounds different from their own. During her interview, Victoria discussed her approach to recognizing cultural differences in her classroom. She explained,

> It makes me appreciate the things we do have here because they don't have as much as we do. [We are] very privileged. I try to let my students know now, that no matter where you're coming from, no matter your situation, you're responsible for your learning. It doesn't matter if you have a lot of nice clothes or food, or the newest games because mainly it's you exploring, learning, and making yourself grow.

Victoria differentiates for herself and for her students between what is important and what is not important.

Additionally, Mitchell acknowledged a shift in her perception of ELLs. In her reflective journal she wrote, "My perception of ELL students has changed. I am now more aware of just how different other schools can be. I can now see some of the hardships ELL students must overcome to have a sense of normalcy." Mitchell compared her experiences in American classrooms with her experiences in the Costa Rican classrooms. Mitchell also translated her ability to connect with individual students in Costa Rica to connect with students in her own classroom. In her interview, she commented,

> I definitely have a different perspective about kids coming from other countries. I currently have a student who is from Puerto Rico, and I've been to Puerto Rico. Sometimes just talking to him about some of the places that he knows and that I've been

> to, kind of makes a connection. I also have three study abroad students. I have one from Korea, one from Belgium, and one from Czech Republic. It's neat to see that they're getting some lessons on how cultures are different, do things different, experience things different—schools are different.

Mitchell expressed the ability to recognize cultural differences. Ultimately, this ability translates into understanding students. As Victoria attempted to capture the essence of the course objectives, she wrote, "If you have a better understanding of your students, you can modify your lesson [for different] ability levels." Victoria's statement indicates her commitment to adapting classroom curriculum for all learners in her classroom.

Chapter Summary

Chapter 4 began with a summary of the context of the study abroad experience and this study. The findings of this study included four themes. The four themes of this study were Experiencing Science in Costa Rica, Studying Abroad in Costa Rica, Transferability of Science Experiences, and The Multicultural Classroom. Case reports for each of the two participants were presented. Each case report introduces the participant and includes evidence from the data sources to support the uniqueness of each case. In the cross-case section, each theme and respective categories were described and supported by evidence collected from both participants to comprise the cross case analysis.

CHAPTER 5: Discussion, Summary, and Recommendations

Chapter 5 is a discussion of the findings. This chapter begins with an overview of the findings, including connections to scholarly literature. The themes developed from the participants' experiences will be substantiated with scholarly literature to identify best practices, including recommendations, for higher education decision makers who plan, implement, and evaluate effectiveness of high-quality, science-focused study abroad experiences for preservice teachers to acquire science content knowledge (Kernaghan, 2012). Additionally, an emerging concept which encompasses study abroad, science education, and preservice teachers is considered. Chapter 5 concludes with limitations of the study, recommendations for future research, and implications for study abroad decision makers and stakeholders.

Overview of Findings

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they were using their study abroad experiences in science curriculum planning and in classroom instruction at the time of the study. Participants of this study were enrolled in the course Environmental Science and Multicultural Experience for K – 8 Teachers, which included a two-week study abroad experience in Costa Rica. The activities of the course included observing Costa Rican classrooms and participating in field science activities. The participants explained their study abroad experiences and their classroom applications via reflective journals created during their time in Costa Rica, and concept maps and interviews completed during the study. The sources of data were analyzed and four themes were identified: (1) experiencing science in Costa Rica, (2) studying abroad in Costa Rica, (3) transferability of science experiences, and (4) the multicultural classroom.

Existing Literature

In a review of the literature, scholarly literature regarding science-focused study abroad experiences for preservice teachers was not apparent. Farris (2012) asserts the need to discover the potential impacts of study abroad on intellectual development and Lalley (2009) suggests the need to assess how study abroad supports preservice teachers. However, some scholarly literature covers study abroad opportunities for students in science, general education, or multicultural education. Thus, the findings of this study are unique and contribute the body of literature for preservice teacher education in science and study abroad. Some findings of this study are in alignment with existing research, which includes the following ideas. The findings here are those which resonated most with the participants of this study.

Costa Rica is Your Oyster. Costa Rica continues to be an optimal site for study abroad programs. In a study of counselor education students, the researcher sought to explore the experiences of graduate students in a counselor education program. The research studied students experiences and the meanings the students made while studying abroad in Costa Rica (Rodriguez, 2014). Costa Rica provided opportunities for service-learning for one group of counselor education graduate students. Service-learning is an approach to incorporating community service into academic learning. Costa Rica affords opportunities include visiting local health clinics, organic farms, and grade schools (Rodriguez, 2014). In one study, students visited Costa Rica during *Virgen de los Angeles*. *Virgen de los Angeles* is a community celebration for the patron saint of Costa Rica. Part of the celebration included church service and a pilgrimage to the town of La Fortuna (Rodriguez, 2014).

Developing Cultural Competency. During the study abroad experience, the participants completed observations at schools in the local Costa Rican village. Both participants reported

being affected by the time spent with the students in the Costa Rican schools. Victoria reported being more appreciative after seeing the limited resources in the Costa Rican classroom—she shares this point of view with her students (Menard-Warwick & Palmer, 2012; Moline, 2009; Northcote et al., 2014). Mitchell reported having a deeper understanding of the struggles English language learners (ELLs) face in the English-speaking classroom and has incorporated culturally-sensitive strategies that aid in instruction in her science classroom (DeVillar & Jiang, 2012; Palmer & Menard-Warwick, 2012). In a study of preservice teachers who studied abroad in Italy, researchers attempted to enhance students' multiculturalism and global awareness via study abroad. Student perceptions and global competence was measured with a questionnaire, interview journals, and a profile of a globally competent student. Similar to the findings of this study, researchers found student views of different cultures and self-awareness had transformed as a result of the study abroad experience (Vatalaro et al., 2015).

In Northcote et al's (2014) cross-case analysis of preservice teacher study abroad experiences, three cases were analyzed to find the commonalities and the nuances of the cases. The three cases included two overseas experiences and one on-campus experience. Each case provided cultural education to students. The goal of this research was to understand students' understanding of culture. Similar to the findings of this study, cultural immersion coupled with teaching abroad is credited with sustaining cultural understanding (Northcote et al., 2014).

Reflection Regarding Themes

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. Scholarly literature is limited, indicating a need for this study. After data

collection and analysis, it was expected the resulting themes would indicate science experience and teaching as result of study abroad. Four themes were identified as a result of data analysis. They include: (1) experiencing science in Costa Rica, (2) studying abroad in Costa Rica, (3) transferability of science experiences, and (4) the multicultural classroom. The four themes are different; but, they all linked as they are identified as impacts of preservice teachers studying science abroad in Costa Rica.

As a result of enrolling in the study abroad course, teachers can expect to authentically experience science in the field, learn culturally sensitive instructional strategies, and explore Costa Rica. In order for the study abroad experience to influence the participants, participants must engage with students at the Costa Rican schools and participate in multicultural seminars, field science activities, and excursions. These types of participant activity related to the first step of Experiential Learning Theory—concrete experience. Additionally, contemplation about the experience played a critical role in the retention experiences and contributed to the second phase of experiential learning—reflective observation. As teachers designed lessons during curriculum planning, the third phase of experiential learning was achieved—abstract conceptualization. Finally, during science instruction, teachers realize phase 4—active experimentation.

Participants described the factors which influenced their excitement for science concepts as a result of participating in study abroad. Participants reported gains in confidence in science as a result of vocabulary during pre-lab instruction, hands-on instructional methods during field science activities, and having the opportunity to experience the forest first-hand. Additionally, participants reported benefitting from group members and whole-class discussion of culturally sensitive strategies, and shifts in cultural competency through observations in the Costa Rican classrooms. The impact of participating in Environmental Science and Multicultural Experience

for K – 8 Teachers and the corresponding study abroad experience in Costa Rica ultimately affected the participants' classroom instruction and students' science-confidence.

Implications for Study Abroad Decision-Makers and Stakeholders

The objective of well-designed teacher education programs is to prepare preservice teachers to develop curriculum, prepare learning environments, and assess leaners. Standards are in place for the preparation of preservice science teachers and support of newly hired science teachers (Luft et al., 2015). However, if the needs of newly hired science teachers are not being met then they enter the classroom with limited content knowledge (Luft et al., 2014). Effective teacher education programs that include powerful experiences in authentic classrooms, where students are working through curriculum, deepen science understanding. Field experiences are one approach to achieve a powerful experience. Field experience is a vehicle for achieving constructivist learning—or learning by doing (Thompson et al., 2013). One example of a constructivist field experience to prepare future science teachers, which warrants exploration is science-focused study abroad (Jefferies & Nguyen, 2014).

The findings of this study have the potential to change current thinking about the role of field experiences in teacher education. Through the experiences of this science-focused study abroad course, preservice teachers were able to contribute to science education by developing their science background, comfortability to teach science, and excitement for science. Additionally, as a result of the science experiences from studying abroad, teachers were able to adopt science instructional methods during classroom practices including science writing as a means for science communication for themselves and their students. This portrays a transfer of learning from teacher study abroad experience to student classroom experience.

Higher education decision makers can elect to plan and implement science-focused study abroad experiences for preservice teachers to provide opportunities for science experiences and multicultural education. Participants discussed gains in science confidence via collaborative grouping in the field. Additionally, participants reflected on their own experiences, personal and professional growth, and new experiences traveling abroad in biologically-diverse, culturally-rich Costa Rica. Moreover, participants were able to relay their science experiences to their students in their own classrooms with improved confidence and interest in teaching science. Participants are able to select engaging curriculum and deliver curriculum with appropriate science pedagogy while addressing needs of culturally-diverse learners. Participant cultural competency also developed because of this science-focused study abroad. Lastly, decision-makers and stakeholders in science-focused study abroad must ensure that this type of course has a place in higher education curriculum because of its benefits for developing competent science teachers who deliver engaging science curricula to students with culturally-sensitive instructional strategies.

For stakeholders of science-focused study abroad—the teachers and the students, the goal of a well-designed science classroom is success in science. Through the field science activities in Costa Rica, teachers developed science background in the following topics: Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment, Weather and Climate, Earth's Systems: Processes that Shape the Earth, Matter and Energy in Organisms and Ecosystems, Structure and Properties of Matter, and Human Impacts. Additional stakeholders include campus administrators and parents—administrators and parents are interested in the success of a school's students. Administrators would be pleased at the strides science teachers

are making in their classrooms and parents would be equally delighted that their children are making progress in the science classroom.

Recommendations for Future Research

The participants for this study were from one study abroad program at one university. The first area of concern is to continue the same direction of research but with an increased number of participants. Additional research areas include utilizing participants from the same program during different instances of travel to understand if other instances of study abroad illicit the same responses in regard to science experiences, multicultural education, and cultural competency. Continuing to be comparative in nature, other science focused study abroad experiences for preservice teachers must also be explored for similar benefits.

The length of this study abroad experience was two weeks. Providing a study abroad experience with a longer time abroad or one, which is repeated over several summers may produce richer science experiences and multicultural education. Exploring advantages of a study abroad course over a home-based science course for preservice teachers, merits examination. While this study abroad course provided rich field science activities, further investigation into a more science-inclusive course may produce science learning to address an increasing number of learning standards, which may include a pre-travel science content course and post-travel curriculum design course.

Furthermore, data collection occurred during one post-study abroad visit with each participant. It may be advantageous to follow up with participants regularly throughout the school year for an extended period of time to produce a comprehensive, longitudinal study. Even more so, a preservice/in-service teacher mentorship component can be developed to mediate post-travel data collection.

Last, each facet of the study abroad experience can be further teased from the study to investigate variability of effects among the participants. Such variables include audience (preservice or in-service teachers), location of study abroad, time of year of travel, length of stay abroad, and purpose for study abroad (life, physical, or earth science, multicultural education) or role in a student's degree plan.

Summary and Conclusion

The purpose of this study was to explore the experiences of classroom teachers who participated in a science-focused study abroad during their time as a preservice teacher and to explore how they are using their study abroad experiences in science curriculum planning and in classroom instruction. This study is guided by two research questions: 1) what are the study abroad experiences that have influenced classroom teachers; and, 2) how do classroom teachers incorporate study abroad experiences into science curriculum planning and instruction in the classroom? Some findings of this study can be found in scholarly literature including study abroad for science, general education, or multicultural education; however, findings related to science-focused study abroad benefits for preservice teachers are not apparent.

In this study, participants were exposed to authentic science practices as modeled by the faculty during field science activities. They also utilized science lab and field tools and were familiarized with a problem-based learning approach to science inquiry. Their hands-on experiences while touring Costa Rica strengthened their confidence in, attitude toward, and perception of science. Most importantly, reflection played a critical role as they explored their purpose in science education—engaging students in their own science confidence. Touring Costa Rica engaged the preservice teachers in the sights, sounds, and culture of land and the

people. Last, participants recognized struggles of ELLs in the classroom and studied culturally-sensitive instructional strategies that further developed their own cultural competency.

Each of these components of the study abroad course plays an integral role in preservice teacher development in order to produce a competent in-service science teacher. Participants' classroom practices have been influenced by the authentic field science activities in a way that encourages teacher implementation of constructivist science skills during instruction of science lessons. Additionally, teachers have been taught culturally-sensitive instructional strategies during the multicultural seminar which can be implemented for international students and/or English language learners (ELLs). Participants had a better appreciation of and excitement for science which was empowering for curriculum planning and classroom instruction. Implementing science-focused study abroad experiences in higher education has a great potential for positively impacting authentic science experiences for participants and future science teacher education students who study abroad; and, thus, bringing science full circle.

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APPENDIX A: IRB APPROVAL LETTER

APPROVAL DATE: September 8, 2016

TO: Ms. Stephanie Medina

CC: Dr. Tonya Jeffery, Dr. Elsa Gonzalez, Cynthia Hopkins

FROM: Office of Research Compliance Institutional Review Board

SUBJECT: Initial Approval Protocol Number: #80-16

Title: Understanding science learning and teaching via science-focused study abroad experiences of classroom teachers

Review Category: Expedited

Expiration Date: September 8, 2017

Approval determination was based on the following Code of Federal Regulations:

Eligible for Expedited Approval (45 CFR 46.110): Identification of the subjects or their responses (or the remaining procedures involving identification of subjects or their responses) will NOT reasonably place them at risk of criminal or civil liability or be damaging to the their financial standing, employability, insurability, reputation, or be stigmatizing, unless reasonable and appropriate protections will be implemented so that risks related to invasion of privacy and breach of confidentiality are no greater than minimal.

Criteria for Approval has been met (45 CFR 46.111) - The criteria for approval listed in 45 CFR 46.111 have been met (or if previously met, have not changed).

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

Provisions:

Comments: The TAMUCC Human Subjects Protections Program has implemented a post-approval monitoring program. All protocols are subject to selection for post-approval

monitoring. This research project has been approved. As Principal Investigator, you assume the following responsibilities:

1. Informed Consent: Information must be presented to enable persons to voluntarily decide whether or not to participate in the research project unless otherwise waived.

2. Amendments: Changes to the protocol must be requested by submitting an Amendment Application to the Research Compliance Office for review. The Amendment must be approved by the IRB before being implemented.

3. Continuing Review: The protocol must be renewed each year in order to continue with the research project. A Continuing Review Application, along with required documents must be submitted 45 days before the end of the approval period, to the Research Compliance Office. Failure to do so may result in processing delays and/or non-renewal.

4. Completion Report: Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the Research Compliance Office.

5. Records Retention: All research related records must be retained for three years beyond the completion date of the study in a secure location. At a minimum these documents include: the research protocol, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to participants, all correspondence to or from the IRB or Office of Research Compliance, and any other pertinent documents.

6. Adverse Events: Adverse events must be reported to the Research Compliance Office immediately.

7. Post-approval monitoring: Requested materials for post-approval monitoring must be provided by dates requested.

APPENDIX B: CONSENT FORM

Understanding Science Learning and Teaching via Study Abroad Experiences of Classroom Teachers

Introduction

The purpose of this form is to provide you information that may affect your decision as to whether or not to participate in this research study. If you decide to participate in this study, this form will also be used to record your consent.

You have been asked to participate in a research project studying the experiences of classroom teachers who have studied abroad and to explore how they are using their study abroad experiences in their own classrooms. The purpose of this study is to describe the study abroad experiences that have influenced developing science content knowledge of classroom teachers and explore how science teachers incorporate study abroad experiences into curriculum planning and instruction in the classroom. You were selected to be a possible participant because you were a student in the course, Environmental Science for the EC – 12 Multicultural Classroom. Additionally, you have attended a science-focused study abroad at the Soltis Center in Costa Rica during this course. Last, you are the teacher of record in your own classroom during the 2015 – 2016, school year at a Texas public school.

What will I be asked to do?

If you agree to participate in this study, you will be asked to construct a concept map to illustrate the science content knowledge you acquired while studying abroad, participate in a face-to-face interview(s), and submit your Rite in the Rain science field notebook. This study will take approximately three to four hours.

Your participation will be audio recorded. If you wish to not be audio-recorded, you will not be eligible to participate in this study.

What are the risks involved in this study?

The risks associated in this study are minimal, and are not greater than risks ordinarily encountered in daily life.

What are the possible benefits of this study?

The possible benefits of participation include contributing data to a growing body of knowledge surrounding study abroad as it supports science classroom teachers, informing professional development for pre-service teachers, and transforming teacher education in Texas A&M System Schools.

Do I have to participate?

No. Your participation is voluntary. You may decide not to participate or to withdraw at any time without your current or future relations with Texas A&M University-Corpus Christi being affected.

Will I be compensated?

You will receive a $50.00 gift card to Starbucks from the PI as a token of appreciation. Disbursement will occur at the end of the study.

Who will know about my participation in this research study?

This study is confidential and no identifiers linking you to this study will be included in any sort of report that might be published. Research records will be stored securely and only Stephanie Medina will have access to the records.

If you choose to participate in this study, you will be audio recorded. Any audio recordings will be stored securely and only Stephanie Medina will have access to the recordings. Any

recordings will be kept until transcribed, after which they will be deleted from the PI's audio-recorder and laptop. Transcription data of interviews will be kept for a minimum of five years and then erased.

Whom do I contact with questions about the research?

If you have questions regarding this study, you may contact Stephanie Medina at 210-487-1633 or stephanie.medina@tamucc.edu.

Whom do I contact about my rights as a research participant?

This research study has been reviewed by the Research Compliance Office and/or the Institutional Review Board at Texas A&M University-Corpus Christi. For research-related problems or questions regarding your rights as a research participant, you can contact Caroline Lutz, Research Compliance Officer, at (361) 825-2497 or caroline.lutz@tamucc.edu.

Signature

Please be sure you have read the above information, asked questions and received answers to your satisfaction. You will be given a copy of the consent form for your records. By signing this document, you consent to participate in this study. You also certify that you are 18 years of age or older by signing this form.

_____ I agree to be audio recorded.

_____ I do not want to be audio recorded.

Signature of Participant:_____ **Date:** _____

Printed Name: _____

APPENDIX C: INTERVIEW QUESTIONS

1. General
    a. Tell me about your background in learning science.
    b. Tell me about your background in teaching science.
    c. Tell me about your background in study abroad—have you traveled or studied abroad before?
2. Time Spent in the Forest – Tell me about your activities in the forest.
3. Time Spent in the Costa Rican Classroom
    a. Walk me through a Costa Rican grade school classroom—what am I likely to see?
    b. What was the extent of your interaction with the Costa Rican students?
    c. How do you feel working with the Costa Rican students will benefit your instructional practices in your own classrooms?
4. Time Spent in the College Classroom – Can you describe an aha moment during discussion with your peers which reflects a valuable lesson for your own classroom?
5. Downtime and Reflection
    a. Tell me about your experiences during down time at the research center.
    b. Tell me about your experiences during down time outside of the research center (e.g. excursions, sight-seeing, tourism, etc.).
6. After Study Abroad in Your Classroom

a. To what extent have you spent planning and incorporating new science content knowledge acquired in Costa Rica in your classroom curriculum and instruction?

b. How have/will you adapt the science content knowledge acquired in Costa Rica in your classroom curriculum and instruction?

APPENDIX D: SCIENCE-FOCUSED STUDY ABROAD FIELD EXPERIENCES

How do you read a map?

- Interpret landscape from a topographic map
- Construct a topographic profile
- Measure distance and elevation on a map

How do you make a topo map?

- Create a topographic map

How many trees are there?

- Explain how tree height and diameter are measured
- Estimate the number of trees in a watershed

How steep is that hill?

- Measure distance and elevation change
- Create a topographic profile from field data

Where did that water come from?

- Identify the different sources, sinks, and pathways of water in a typical watershed
- Describe the relative importance of precipitation and clouds to the local water budget
- Describe the hydrologic cycle of a cloud forest

How much water is that?

- Explain how river discharge is measured
- Explain the relationship between precipitation and river flow

Additional Field Science Activities

Nighttime Animal Survey

Orienteering

Soil Quality Testing

Problem-Based Learning Final Exam

Science Excursions

Mount Arenal

Tarcoles Bridge

Jaco Beach

Safari Rafting

Baldi Hot Springs

ICE Hydroelectric Plant at Rio Peñas Blancas

Aquaculture Center

Tilapia Farm

APPENDIX E: REFLECTIVE JOURNAL ENTRY PROMPS

1. As part of this course we will be exploring cultural sensitivity and cultural sensitivity as it applies to classroom strategies, teaching, and learning.

a) How sensitive do you feel you are to cultures different from your own? Describe at least two prior experiences that have influenced your cultural sensitivity (positively or negatively). Describe how you think your cultural sensitivity may influence your interactions with Costa Rican teachers and students.

b) Each participant in this course will also bring with them a certain background in environmental science. In what ways have you built your content knowledge in environmental science (e.g., courses, field work, hobbies, research)?

2. After touring the Soltis Center facilities and the cloud forest today, what areas of environmental science included as part of the course most interest you? How do you think these topics are relevant to the topics you will teach in your own classroom? Thinking about the conditions and climate of Costa Rica, how is this related to real science and the challenges in teaching science?

3. Imagine that the students you observed this afternoon are your students. What kinds of culturally sensitive activities might you employ in your classroom? What kind of background knowledge or classroom skills do you think your Costa Rican students would require in a U.S. classroom to "get the job done?"

4. Think about how you would plan and execute a lesson plan about volcanoes (without clay, baking soda, and vinegar). More specifically describe how you think a volcano lesson in Costa Rica would differ from a volcano lesson in Corpus Christi (or Illinois)? After observing the

Costa Rican students yesterday, how do they differ from students you have observed in American classrooms?

5. In what ways has your experiences this week in the Monteverde Forest and Mount Arenal influenced your perceptions and/or your level of confidence teaching science?

6. Today we spent time in a beach environment similar to and also very different from the beach environment in Corpus Christi. What experience today stood out the most for you and how might you be able to share that experience with your students?

7. How has participating in this course influenced your approach to planning environmental science activities for your own classroom? What will you take into consideration when making accommodations for students who speak languages other than English or have a different cultural background than yours when teaching environmental science?

8. Communicating science with students from a culture different than yours can be challenging-especially if a language barrier exists. Explain how transformation of information could play a role in planning science activities for your multicultural classroom? Describe at least two experiences/examples of how using transformation of information has helped you to understand and/or communicate science.

9. Based on your observations and interactions at the Costa Rican school, describe at least three differences you have noticed between Costa Rican schools and students and American schools and students. Topics to consider may include: classroom management, student behavior, parent involvement, homework, lab activities, test administration, classroom procedures, access to technology, note taking methods, etc.

10. Reflecting on your time spent here in Costa Rica, describe the ways in which your cultural sensitivity has changed or has remained unchanged over the past ten days.