

TEACHERS' CONCEPTUALIZATIONS AND CLASSROOM INCLUSION OF OCEAN
LITERACY FOLLOWING AN INTENSIVE MARINE SCIENCE PROFESSIONAL
DEVELOPMENT PROGRAM

by

CATHERINE LINDSAY LINSKY

(Under the Direction of Norman Thomson)

ABSTRACT

The following study details teachers' conceptualizations and classroom inclusion of ocean literacy following an intensive marine science professional development program in Hawai'i known as Project ISLE (Integrated Science Learning Experiences). During this two-week program, 12 teachers studied science content and pedagogy concerning volcanology, astronomy, marine biology, island ecology, and conservation. Through qualitative methodologies, eight assertions were formulated from a thematic data analysis. Generally, the teachers' personal backgrounds had a large influence on their individual conceptualizations and classroom inclusion of ocean literacy. The participants also placed a high value on their "real life" experiences in Hawaii, especially those pertaining to ocean life, ocean-human interactions, and the Hawaiian culture. This study furthers the up-and-coming field of ocean literacy and sheds light on the needs of professional development in this area.

INDEX WORDS: Ocean literacy, Marine science, Environmental education, Professional development, and Experiential education

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DEDICATION

This dissertation is dedicated to my husband. I can never thank you enough for supporting me through years of late night classes, countless hours of typing, and the innumerable other challenges that come with completing a doctorate degree. You are an indescribable blessing to my life.

Trust in the Lord with all your heart on your own intelligence rely not;

In all your ways be mindful of him, and he will make straight your paths.

Proverbs 3:5-6

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Psalm 31:5

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Chapter 1

INTRODUCTION

Background of the Problem

In the preface to *Values at sea: Ethics for the marine environment*, Dorinda Dallmeyer made the following observation: “Although earth is dominated by the oceans, the vast majority of analytical discussions of environmental ethics address terrestrial or freshwater environments” (2003, p. ix). The same can also be said for Environmental Education. Although the majority of our planet is covered with ocean water, the vast majority of the discourse concerning environmental education in schools only addresses the areas we call home. Dallmeyer explains, “because humans have not known the ocean well, it has not been viewed as central or as of the same value as the terrestrial environment, where humans’ familiarity with animals and plants makes it easier for us to comprehend the threats these organisms face” (2003, p. ix). Indeed, as land-dwelling organisms, humans are naturally biased toward terrestrial issues. Bryan Norton (2003) calls this notion “terrestrialism,” which explains why oceans tend to be “out of sight, out of mind” (p. 33). The U.S. Commission on Ocean Policy’s Report to Congress in 2004 contained similar findings, reporting that half of the U.S. population has had little or no experience with oceans or coastal areas. Similarly, of the k12 students Brady and Koch (1990) researched, 86% had little or no knowledge of key ocean understandings and had misconceptions that would significantly impact their ocean decision-making abilities (as cited in Tran et. al.

2010, p. 22). More recently, a nationwide longitudinal study of the American public's views about the ocean found that only 35% of those surveyed could identify a single ocean issue affecting the country (The Ocean Project, 2009). A 2003 survey commissioned by the American Association for the Advancement of Science (AAAS) similarly found that, while the public at large is concerned about the state of the oceans, only 31% understood that their daily choices could have a direct or indirect impact on the oceans (2003). However, the best summarization of the need for ocean literacy came from Dr. Sylvia Earle's (2011) presentation at the National Marine Aquarium, which explained that the greatest threat to our oceans comes from our own ignorance, and that "you have to know about it to care about it."

The Ocean-Human Impact

Ocean illiteracy, or the lack of knowledge pertaining to the ocean-human relationship, can have a tremendous impact on the oceans due to our close connection to the marine world. According to the National Oceanic and Atmospheric Administration (NOAA), our connection to the ocean is greater than most would expect:

The United States has more than 95,000 miles of coastline and more than 3.4 million square miles of ocean within its exclusive economic zone...More than one-half of the U.S. population now live and work within 50 miles of the coastline...U.S. residents ate an average of 15 pounds of fish and shellfish last year. Globally, seafood represents one-fifth of animal protein and 5 percent of the total protein in the human diet... One of every six U.S. jobs is marine-related, and one-third of the nation's gross domestic product is produced in coastal areas through fishing, transportation, recreation and other industries dependent on healthy waters and marine habitats. More

than one-half the U.S. population lives in coastal areas (NOAA, 1998, <http://www.yoto98.noaa.gov/facts/gen.htm>).

As Hoffman & Barstow (2007) illustrate: “Long-term changes in ocean and atmospheric processes impact national economies, agricultural production patterns, severe weather events, biodiversity patterns, and human geography” (p .9). What’s more, all citizens are connected to the ocean through the water cycle, so we are all responsible for ocean issues through non-point source water and air pollution, fish consumption, etc. (Pew Oceans Commission, 2003). A resource that has such a tremendous impact on all of our lives should be among the most highly valued topics in education today. Unfortunately, however, the education community at large has yet to acknowledge this need in national and state standards.

History of Ocean Literacy

The *National Science Education Standards*, published in 1996, contained very little concerning ocean topics (Schoedinger, et. al., 2010, p. 3). After the national standards were published, most states followed suit and included few or no oceanic topics in their standards. Both publicly and privately funded national commissions noticed this deficit and declared the immense need for ocean literacy. For example, the privately funded Pew Oceans Commission’s (2003) *A Report to the Nation: “Recommendations for a New Ocean Policy”* called for the creation of a revised national ocean policy designed to restore ocean ecosystems and build “a national constituency for the oceans that includes all Americans, whether we live along the coast or in the Rocky Mountains. We must prepare today’s children to be tomorrow’s ocean stewards” (p. 91). They propose that this policy include “ocean education and awareness through a commitment to teach and learn about our oceans at all levels” (p. ix). More specifically, the publicly funded U.S. Commission on Ocean Policy (2004) explained “School curricula, starting

in kindergarten, should expose students to ocean issues, preparing the next generation of ocean scientists, managers, educators, and leaders through diverse educational opportunities” (p.122). Other concerned groups echoed the sentiments of those described above, including the Independent World Commission on the Oceans (Soares, 1998) and officials within the American Association for the Advancement of Science, who argued, “the public is deeply concerned about the environmental challenges facing our oceans and coastal regions and, given information and a voice in the discussion, is willing to back up that concern with personal action” (2004; as cited in Steel et al., 2005, p. 99). In other words, ocean educators and scientists realized that, if educational trends were allowed to continue on this terrestrial-focused trend, the U.S. would continue to have a population with little knowledge or experience pertaining to oceanic or aquatic ecosystems (Steel, Smith, Opsommer, Cruiel, and Warner-Steel, 2005).

The alarming gaps in student understanding and the lack of oceanic elements in the national and state science standards sparked the creation of the topic of ocean literacy, or “...understanding the ocean’s influence on you and your influence on the ocean” (Ocean Literacy Network, 2005). Prior to the formation of the official definition, the Ocean Literacy Initiative (2004-2005) conducted an online workshop to identify what ocean literacy is and what individuals need to know about the ocean. They determined that ocean literacy is “...the awareness and understanding of fundamental concepts about the functioning of the ocean-atmosphere-earth system. An ocean-literate person recognizes the influence of the ocean on his/her daily life, can communicate about the ocean in a meaningful way, and is able to make informed decisions to ensure the ocean continues to sustain a habitable planet” (Ocean Literacy Initiative, 2004-2005, p. 3).

Later, The Ocean Literacy Network created a framework that includes *Ocean Literacy*:

The Essential Principles of Ocean Sciences and Ocean Literacy Scope and Sequence for Grades K-12 (Ocean Literacy Network, 2005, 2010). Over a period of 14 years, ocean educators and scientists associated with general k12 education, universities, the National Geographic Society, the Center for Ocean Sciences Education Excellence, and many other groups collaborated to create the framework, which was formally released in the spring of 2010 (NMEA, 2010). Hoffman and Barstow (2007) explained the importance of the work in their federally funded report: “This document has had a remarkably important impact on the field of Earth system science education, providing clear guidance to states as they revise standards and develop assessments” (p.11). For a more detailed version of these principles and how teachers can include this information at various grade levels, please see the Ocean Literacy Scope and Sequence (Ocean Literacy Network, 2010), or Appendix A.

The Current State of Ocean Literacy in Schools

Unfortunately, the Ocean Literacy Network’s efforts have done relatively little to alleviate the chasm that exists between ocean destruction and ocean education. As Strang (2008) noted, “The absence of ocean sciences in schools resulted in a generation of Americans largely ignorant of the importance of the ocean, which in turn has made it even more difficult to convince the adults in our school systems to insert ocean concepts into future standards” (p. 7). In other words, the marine environment is being largely ignored in educational settings, and schools are producing a citizenry that is largely ocean illiterate. In their nationwide study of state Earth Science standards, Hoffman and Barstow (2007) found that 47 states and the District of Columbia included a few ocean literacy principles in their standards, and no state addressed more than 20 of the 45 total fundamental concepts. What’s more, most states only addressed concepts indirectly (e.g. the water cycle), as opposed to specifically mentioning the ocean. Even

the coastal states only had an average of about 11 fundamental concepts. If future generations are to enjoy the resources and benefits of a healthy ocean ecosystem, and if marine ecological disasters are to be avoided, then educators across the country need to include ocean literacy in their classrooms on a regular basis.

The Need for Ocean Literacy Professional Development for Teachers

According to a “Science Content and Standards for Ocean Literacy” survey (Cava et al., 2005) 80% of participants believed professional development for teachers to be an important issue, and felt the opportunities for adequate preparation in ocean education were missing from the educational community. The respondents explained that they believed the dearth of ocean literacy professional development could be attributed to a lack of funding, inability to support larger numbers of teacher participants, and an absence of programs in certain geographic locations. Some even admitted that they felt unmotivated to attend such programs. This lack of ocean pedagogical preparation is especially concerning, since “what is actually taught in the classroom depends upon the interaction between the planned curriculum and the particular characteristics of the teacher, including their subject matter knowledge and related experiences” (Gillian, 2011). Hoffman and Barstow (2007) also support the idea of a “two-pronged approach” to the advancement of ocean literacy through both standards inclusion and teacher preparation:

Teachers must be provided with the professional knowledge and skills, as well as curricular resources, to better integrate ocean literacy education into their teaching.

Therefore, the ocean literacy and Earth system science education community should pursue a two-pronged approach that simultaneously focuses on revising state standards,

when opportune, while simultaneously taking steps to making teachers aware of the importance of including ocean literacy principles (p. 58).

In other words, if we are to move forward as an ocean-literate society, our teachers must be prepared to educate the next generation of ocean stewards.

Statement of the Problem

This study attempts to understand the issue of the impacts of professional development programs on teachers with respect to ocean literacy. Specifically, I investigate a marine science-oriented professional development program on teachers' conceptualizations and classroom inclusion of ocean literacy. To address this research focus, I acted as participant-observer and co-leader for a program known as Project ISLE (Integrated Science Learning Experiences), which took place on the Big Island and Maui in Hawaii (see Site Selection section). Through surveys, field observations, interviews, archival data, and classroom observations, I examined the 12 Project ISLE teacher-participants' descriptions, intentions, and actions with respect to ocean literacy.

Significance of Study

As Garet et. al. (2001) explain, "little research has been conducted on the relative efficacy of professional development activities that focus on different types of knowledge, skills, and teaching practices" (p. 923). Ocean literacy education is no exception. If the educational community is going to be prepared to adequately foster strong teachers of ocean literacy, a solid body of research must be in place to form the foundation of the pedagogical methods and procedures for workshops, courses, and programs. However, since the start of the Ocean

Literacy movement, very little research has been conducted concerning the teaching and learning of the subject. In fact, the majority of peer-reviewed research studies located pertained to student learning and Ocean Literacy levels as a result of a school-based ocean programs (Plankis, 2009, Marrero, 2011, Plankis & Marrero, 2010). The only research located that specifically pertained to the teaching of ocean literacy were two unpublished theses concerning the perceived barriers to teaching ocean literacy (Gillian, 2011; Stock, 2010), with one study (Gillian, 2011) including an investigation as to whether the availability of professional development opportunities influenced teachers' perceptions. However, I was unable to locate any studies specifically concerning the professional development of teachers around ocean literacy.

Research Questions

In view of the lack of knowledge about teachers' development and inclusion of ocean literacy, I formulated the following research questions as the focus of this study before, during, and after Project ISLE (Integrated Science Learning Experiences):

What are the impacts on:

1. teachers' conceptualizations and
2. classroom inclusion,

of ocean literacy following an experiential marine science-oriented professional development program?

- a. How do teachers' conceptualizations about ocean literacy develop, if at all, throughout the program?

- b. What components, if any, of ocean literacy do the teachers include in their classroom instruction?
 - i. Which ocean literacy components do the teachers state they include prior to the program begins?
 - ii. How does their ocean literacy component inclusion change, if at all, after the program?
- c. Which components came from their experiences in the program?
- d. Why did they make the choices for (i) inclusion, or (ii) non-inclusion of “b.” and/or “c.”?

Definition of Key Terms

In an attempt to better comprehend my research questions, I developed the following definition of key terms used within the research questions:

Effect: Impacts; positive/negative changes or shifts that occur as a result of an occurrence, event, or experience.

Marine Science: The study of the ocean ecosystem and its many components.

Intensive: An experience that requires participants to be actively engaged over an extended period of time.

Experiential: A learning opportunity that occurs through direct, “hands-on” experience with a given topic (instead of lecture or second-hand account) and often occurs outdoors.

Professional Development: A course or learning experience designed to strengthen teachers’ content or pedagogical knowledge.

Conceptualizations: Understandings and beliefs about a topic in the context of a concept or piece of information. In this sense, both understandings and beliefs inform one another.

Belief: An implicit assumption about a topic that affects a person's attitudes and behaviors with regard to that topic.

Understanding: A person's factual knowledge about a given topic.

Classroom Inclusion: The process of teachers taking information and knowledge from a professional development experience and incorporating it into their classroom instruction and curricula.

Ocean Literacy: A multifaceted, interdisciplinary understanding and appreciation of the ocean that results in applied ocean stewardship, ocean eco-friendly behaviors, ocean advocacy, and ocean research.

Ocean Literacy Components: The 7 Essential Principles and 45 Fundamental Concepts put forth by the National Geographic Society et al. (2005).

Professional Development Program: A learning experience that is not tied to a specific degree sequence, but may result in the acquisition of Professional Learning Units (PLU) and/or a stipend.

Teacher: An adult who works in an educational setting and is charged with the instruction of students in various subjects.

Teacher Development: The professional growth of a teacher over time with respect to content knowledge, pedagogical skills, or self-efficacy.

Personal Definition of Ocean Literacy

Although the official definition of ocean literacy is, “An understanding of the ocean’s influence on you and your influence on the ocean” (National Geographic Society et al., 2003), in my mind, ocean literacy goes beyond just an understanding: literacy implies comprehension. When people truly comprehend something, they are able to transfer that knowledge and apply it to other situations. So it is not just understanding “influence” with regard to the ocean, but also using that understanding in ways that benefit the ocean, and, indirectly, a student. For example, if individuals are ocean literate, then they comprehend (at least) the basics about the ocean and how it works, and in doing so transfer that knowledge to the choices they make in life (recycling, etc.). Additionally, knowledge of the ocean or a lack of knowledge of specific facts should not be the justification as to whether a person is ocean literate or not. Just because a student cannot name the average temperature of the Gulf of Mexico does not mean that they are not ocean literate. There is no magic threshold that they cross at a certain point in their knowledge that deems them suddenly ocean literate. Similarly, if a student was not able to recite a Shakespearean sonnet, that does not make him or her any less reading literate. At the same time, however, simply recycling materials and picking up litter on the beach is not enough to be considered ocean literate. Individuals must also be able to competently explain why such actions are essential for the health of the ocean; therefore, literacy is not only knowing the “what” about the ocean, but also the “why.” I view ocean literacy as a balance between ocean science understanding and ocean stewardship, with a measure of ocean literacy being how people apply their knowledge to various situations in their lives. In other words, citizens who are ocean literate have enough knowledge about the ocean and their relationship to the ocean so that, as

ocean problems change, they are able to understand the issues and adapt their behaviors so as not to be a source of the problem, but rather a solution to it.

Limitations of the Study

This study examined the conceptualizations and classroom inclusion of ocean literacy as a result of Project ISLE, an intensive marine science-oriented summer program intended for teachers. The study was limited to a small number of teachers (n=12) in one professional development program. Due to time constraints and a lack of funds, I was unable to study the teachers longitudinally beyond the scope of about one year. The teachers' demanding, busy schedules made coordinating multiple observations nearly impossible, so I was only able to interview each teacher individually on one occasion, with one follow-up group interview. However, this study may serve as a baseline for future studies concerning teacher professional development in ocean literacy.

Other limitations included the program itself. Although the program was not specifically designed to increase teachers' ocean literacy, the goals and purposes were strongly tied to ocean science concepts and marine environmental awareness. Teachers' ocean literacy was expected to mature over the course of the program. However, ocean literacy topics were not the only ones addressed. The following describes Project ISLE, the participants involved, and the reasons why teachers enrolled in the program.

Project ISLE is a professional development program offered through a major university in the Southeast. This two-week program on the Big Island and Maui in Hawai'i focuses on volcanology, astronomy, island ecology, conservation, and marine biology. Activities include volcano hikes, observatory visits, sea turtle observation, and fish identification (See Appendix B

for full itinerary). Table 1.1 below depicts the objectives covered during Project ISLE and how they coordinate with the Ocean Literacy Essential Principles and Fundamental Concepts (OLEP&FC). Due to the nature of the funding grant for Project ISLE, the instructional team decided to base the content objectives on the State Performance Standards for elementary science (see explanation p. 62). For each topic (volcanology, astronomy, etc.), the coordinating state standards are listed with their standard code. The first item in the code stands for “Science”, the second item lists the grade level addressed, the third spot lists the topic within science (Earth, Life, or Physical science) and the last item depicts the number of that standard. For example, the first standard code S2E1, stands for “Science Grade 2 Earth Science #1. Half of the Project ISLE participants taught secondary science, and the program addressed many of their standards as well, including standards found within sixth grade Earth Science, seventh grade Life Science, high school Biology, etc.

Table 1.1:

Project ISLE Objectives aligned with Ocean Literacy Essential principles and Fundamental Concepts

Program Objectives	Coordinating Ocean Literacy Principles and Fundamental Concepts
Volcanology (S2E1, S2E3, S3E1, and S5E1) <i>Volcanoes reshape the earth</i>	2d, 2e, 6f, 7b, 7f 2e
Astronomy (S4E1, S4E2, and S4P1) <i>Modern telescopes unlock the mysteries of the universe</i>	
Coral reef ecology and organism identification (S1L1, S2L1, S3L1, S3L2, S4L1, S4L2, S5L1, S5L4) <i>Organisms adapt to unique environments</i>	5a,5b, 5c, 5d, 5e 5f, 5h, 6e, 6g 5a, 5c, 5d, 5f, 5h

Island ecology and indigenous species (S1LI, S2L1, S3L1, S3L2, S4L1, S5L1)	2d, 2e, 6c, 5a, 5c, 5d, 5f, 5h
<i>To classify diverse species</i>	6c, 6g
<i>To protect endangered species</i>	
Other	
<i>To integrate all of these new understandings into their classroom practice</i>	7f

Summary of the Chapter

This chapter introduced the reader to the need for ocean literacy. Due to the ocean's tremendous influence on Americans' daily lives, it is extremely important that the general population understands the oceans enough to be able to make informed decisions as citizens and voters. However, the vast majority of Americans remain largely ocean illiterate due to a lack of education in ocean science topics, and many teachers feel unprepared to instruct students in marine education. Further complicating the problem is the fact that very little research exists to form a foundation for ocean literacy professional development. The purposes of this research study are to continue the discussion about ocean literacy and to better understand the impacts of marine science professional development on teachers' ocean literacy. It is my hope that this research will foster additional work in ocean literacy professional development so that the educational community may better prepare teachers for the important role in the education of the next generation's ocean stewards.

In the chapters that follow, I situate my research among the pertinent literature concerning scientific literacy, environmental education, professional development, and experiential education (Chapter Two). Chapter Three describes the research design and methods, provides a rationale for using qualitative methods, and explains the data collection sites and

participants. The findings of this study are broken up into eight main Assertions in Chapters Four and Five, which coordinate with the research questions regarding teachers' conceptualizations and classroom inclusion of ocean literacy. Finally, Chapter Six ties the findings back in with the literature reviewed and explains potential implications for the data.

Chapter 2

REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

Introduction

I conducted the following review of literature in order to better understand the theoretical, conceptual, and contextual underpinnings of this study. This chapter begins with an explanation of my theoretical framework for the study, or the theories and models used to support the study that serve as a lens through which I can view my work. Next, I examine ocean literacy in depth by describing the conceptual framework, or the approach to the concept of ocean literacy as a whole. Following this discussion, I provide a review of pertinent literature reporting similar research that informed my study's design and data collection. Finally, I examine literature that would help the reader better understand the potential implications of Hawaiian culture as a context for this study. After each section and subsection, I provide descriptions of the possible implications of the information for my present study. I conclude with a summary of the chapter and a brief introduction to subsequent chapters.

Theoretical Framework

The following theoretical framework serves as a guide or lens through which I can view my data and support my overall research study (Doney, 2010; Merriam, 1998). Four major educational theories served as my focus in this framework. Specifically, I examined research that focused on teacher beliefs, situated learning, professional development, and socioscientific

issues. In the sections that follow, I provide a brief background of the theories, discuss research pertaining to professional development, and explain the implications of the information for my research.

Teacher Beliefs

Due to their abstract nature, beliefs are typically difficult to define, and numerous definitions of beliefs exist that inform different aspects of education. First, Vygotsky's (1978) definition of beliefs includes social experiences and how people construct themselves in relation to the world through interconnected inferences. Rokeach (1968) defines beliefs as "inferences made by an observer about underlying states of expectancy" (p. 2). Additionally, Kagan (1992) defines teacher belief as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (65). Although difficult to explicitly define, beliefs are an important part of educational research. According to Pajares (1992), they are the best indicators of how individuals make decisions. Kagan (1992) supports this claim in educational contexts by asserting that beliefs "usually reflect the actual nature of the instruction the teacher provides to students" (73). However, the complex nature of beliefs makes them even more difficult to comprehend. People form beliefs based on a lifetime of experiences that come together "to define a person's epistemologic standpoints from which their beliefs, values and actions are derived" (Osborne, 1998, p. 428; see also Smith, 2005). Also, not all beliefs are created equally within a person's mind. Some beliefs are central to a person's identity and affect numerous aspects of that person's life, while others are more peripheral. For example, Rokeach (1968) stated, "the more a given belief is functionally connected or in communication with other beliefs, the more implications and consequences it has for other beliefs and, therefore, the more central the belief" (p. 5). He goes on to explain how beliefs can be derived from listening to

stories and explanations of others or acquired from personal experience (“underived”). Having direct encounters in the belief-building experience make underived beliefs more powerful due to their “I-saw-it-with-my-own-eyes” nature, thus connecting the belief to a sense of self (Pajares, 1992, 318). For example, individuals can form a belief about species such as snakes from hearing stories from other individuals (derived). Individuals can also develop beliefs based on direct interactions with snakes (underived).

Whether they are first person or secondhand, a person’s beliefs come together to form systems composed of interconnecting and overlapping structures that form complex and intricate constructs. For example, in education, teachers possess beliefs about students, teaching, and learning as well as personal matters outside of school. What’s more, teachers’ personal lives and non-educational beliefs can have a tremendous effect on their practice (Pajares, 1992). For the sake of this study, I examined teachers’ beliefs about a particular subject matter, ocean literacy, and how those beliefs manifest themselves in their classrooms. My operating definition of belief stems from Kagan’s (1992) explanation of beliefs being implicit assumptions about a topic, such as a curriculum or subject matter. Due to the parameters of the research questions, I did not look at how teachers’ beliefs fit into other belief systems or how they manifest themselves in teachers’ personal lives; I focused on teachers’ professional beliefs that were held prior to the start of Project ISLE and those that formed over the course of the program and how those beliefs related to their understandings of ocean literacy within the broader umbrella of their conceptualizations.

Construction and Development of Beliefs. To better understand the impact of Project ISLE on teachers’ beliefs with respect to their conceptualizations of ocean literacy, the following summarizes how beliefs are formed within individuals. First, Smith (2005) explains that individuals form beliefs as a result of a variety of sources, especially in social situations. Pajares

(1992) explains how long-term beliefs can be somewhat difficult to alter. For this reason, early experiences can have a stronger influence on teachers' beliefs about teaching and learning than formal classroom experiences. (Smith, 2005, p. 26). Calderhead and Robson (1991) reported similar findings in their study of pre-service teachers. Their participants' beliefs stemmed from mental images of teaching based on memories of being students. The images influenced multiple aspects of their classrooms including teaching practices, program content interpretation, the translation of knowledge, and classroom management (Pajares, 1992). Similarly, Eraut (1985) and Goodman (1988) explain that "guiding images" in teachers' long term memories direct teachers' educational belief structures because teachers filter new information through those images before being sorted into cognitive structures. (See also Pajares, 1992). Kagan (1992) wrote that beliefs lie "...at the very heart of teaching. Teacher belief appears to arise out of the exigencies inherent in classroom teaching, it may be the clearest measure of a teacher's professional growth, and it appears to be instrumental in determining the quality of interaction one finds among the teachers in a given school" (85).

Beliefs and Knowledge. As described earlier, once beliefs are formed, they are cognitively stored. However, unlike other information stored within a person's mind, beliefs are not synonymous with knowledge. Clark (1988) explains that teachers' beliefs differ from textbook or factual knowledge because they "tend to be eclectic aggregations of cause-effect propositions from many sources, rules of thumb, generalizations drawn from personal experience, beliefs, values, biases, and prejudices" (p. 5). Nespor (1987) explains that beliefs are stored in a different way in a person's mind and also have different affects on a person's life. Nespor contends that knowledge is stored systematically and beliefs are episodically regulated and associated with experiences. Ernest's (1989) study provides a useful example by indicating

how two teachers may have similar factual knowledge but utilize this knowledge in the classroom in very different ways due to their beliefs. In other words, beliefs tend to be emotionally based in terms of cognitive function, while knowledge is factually based.

Teacher Beliefs about Curriculum. As described earlier, teachers' beliefs impact practices directly by guiding their instructional and classroom management decisions (Nespor, 1987; Pajares, 1992; Richardson, 1996; Roehrig et. al., 2007). Although it is important to understand all aspects of teachers' beliefs, understanding teachers' beliefs on their curricula can be especially enlightening. Cheung & Ng (2000) defined teachers' beliefs about curriculum as "a set of value premises from which decisions about curriculum objectives, content, organization, teaching strategies, learning activities and instructional assessment are made" (357). Brown and Melear (2005) provide an example of how curriculum beliefs can influence classroom practice. They explain that when teachers' belief constructs closely coincide with inquiry-based methods, for example, they will be more likely to include inquiry in their classrooms and model authentic science practices. Similarly, in Roehrig, Kruse, and Kern's (2007) study that sought to understand the implementation of reforms in chemistry curricula, they found that teachers' beliefs and community support had significant impacts. They explain that "inquiry teachers all held predominantly transitional and reform-based beliefs, whereas the traditional teachers all held predominantly traditional beliefs about teaching and learning," so the outcome of the reforms in their classrooms looked very different (904).

Limitations of Research on Teacher Beliefs. Due to their abstract nature, beliefs are very difficult to research and understand. In fact, Rokeach (1968) warned that in order to understand beliefs, researchers must infer participants' beliefs because they are often unable to verbalize them. Rokeach goes on to caution that these inferences are further complicated by the

fact that since beliefs are implicit assumptions, teachers may be unable or unwilling to put them into words. Therefore, researchers must examine what teachers say and do in order to gain an understanding of what their underlying beliefs may be. Research participants will give evidence to their beliefs in statements, predisposed mannerisms, and behaviors related to the belief. Pajares expands on this idea by explaining, “if reasonable inferences about beliefs require assessments of what individuals say, intend, and do, then teachers’ verbal expressions, predispositions to action, and teaching behaviors must all be included in assessments of beliefs” (Pajares, 1992, 327). Therefore, multiple forms of data will assist researchers in uncovering these implicit assumptions (Pajares, 1992; Richardson, 1996).

However, assessing beliefs is further complicated by a phenomenon Nespor (1987) calls the “entangled domain.” Since the nature of teaching and education can be so different from one person to the next, beliefs about teaching are vulnerable to becoming confused with other beliefs that seemingly overlap with those typically held in education. When teachers encounter these entangled domains, they may be unsure as to how to proceed because they are uncertain about the appropriate behavior for a circumstance. Further complicating belief research is the reality that throughout the course of a day in school, teachers must make a myriad of interpersonal decisions often in rapid succession, thus forcing them to react on impulse and intuition as opposed to reflective action (Eraut, 1985; Jackson, 1968; Lortie, 1975). Nevertheless, despite the difficulties in studying beliefs, they provide a glimpse into individuals’ personal meaning and their definition of relevancy, thus making them important concepts to study (Pajares, 1992).

Implications for the Present Study. This perception of relevancy that Pajares (1992) describes can have tremendous implications on classroom practice. Since I was unable to observe all 12 participants more than one time each, understanding their beliefs about ocean

literacy granted me limited insight into their classroom practices. However, the observations were able to give me some insight into their beliefs and how their personal experiences influenced their teaching. In addition, through interviews I was able to obtain further information about their beliefs and experiences related to ocean literacy. Many teachers cited memories of early childhood science experiences or exposure to natural settings in their applications and throughout the Project ISLE experience, indicating the possibility that they may have brought deeply held beliefs about the subject to the experience. If they had strong pre-existing, personally derived beliefs regarding ocean literacy, Project ISLE would not have had a strong or lasting effect on their conceptualizations, which I believe are at least partially determined by beliefs (see definitions in Chapter One). On the other hand, since Project ISLE was so intensive and experiential in nature, it could have led to increased guiding images and, therefore, stronger beliefs, since teachers “saw it with their own eyes” (Calderhead and Robson, 1991; Eraut, 1985; Goodman, 1988; Pajares, 1992).

Next, as described in Chapter One, I define conceptualizations as a combination of a person’s beliefs, ideas, and understandings of a topic. In this sense, conceptualizations are much more complex than simply what a teacher knows about a subject. Studies report that teachers’ beliefs can have a stronger impact on their classroom practices than factual knowledge (Roehrig et. al., 2007; Nespor, 1987; Pajares, 1992; Richardson, 1996), especially their beliefs about curriculum (Brown and Melear, 2005; Cheung & Ng, 2000; Munby, 1982). Therefore, teachers’ beliefs were carefully considered. Still, this study took their factual knowledge into account as well, since that can affect their confidence and perception of the subject. In other words, this study focused on what teachers’ believe about ocean literacy and how their understandings about ocean science and the ocean-human relationship inform their beliefs. Recognizing the

differences between beliefs and knowledge helped me comprehend how one informs the other within a teacher's conceptualizations.

Finally, per Rokeach's (1968) cautions about researching beliefs, I utilized multiple forms of data when attempting to understand my participants' beliefs. Similarly, I asked indirect questions in surveys and interviews, which helped to identify their implicit assumptions. I also observed their behavior over the course of a year to better understand what they say, intend, and do (Rokeach, 1968).

Situated Learning

According to the situated learning theory, the environment in which students learn can affect the outcome of their education (Lave & Wenger, 1991). Situated learning scholars purport that student learning depends largely on the social environment in which the learning occurs (Druckman & Bjork, 1994). In other words, students learn different amounts, kinds, and qualities of various content or processes depending on the type of social environment in which the learning takes place. This notion is a continuation of Vygotsky's (1978) theory of social development that supports the notion of learning as a product of multiple functions including educational activities, context of learning, and the culture of the learning group.

Differing from traditional classroom instruction, Lave and Wenger (1991) describe how situated learning focuses on authentic, rather than abstract, knowledge that is embedded within a context or culture and often occurs naturally or unintentionally. They go on to explain how knowledge should be presented to students in natural situations, or contexts that would normally require participants to understand that information. In such situations, collaboration and interaction with peers in a social setting is crucial, and students form groups known as

communities of practice. As individuals learn more about a subject, they move from the outside of the group, where they are novices, toward the “center,” where they would be considered experts. Experts are much more actively engaged in the subject and able to apply it to a number of other contexts.

Situated Learning and Teacher Education. The situated learning theory can inform teacher professional development through a careful examination of the environment in which teachers learn (Korthagen, 2010). Like their students, when teachers learn in authentic environments that mimic “real life” situations they are then able to gain a deeper understanding of the material and can begin to move toward the “center” of the community of practice for the field, thus becoming more actively engaged in that area of knowledge.

Implications for the Present Study. Throughout the Project ISLE program, the teacher participants had ample opportunity to learn in social contexts (Druckman & Bjork, 1994). The teachers’ learning experiences took place over an extended period of time, with an initial meeting in May, followed by the two weeks in Hawai`i, and a concluding meeting in September. Such in-depth experiences should, theoretically, have a greater impact on learning. Additionally, although several of the Project ISLE experiences consisted of lectures, many more activities were interactive and naturally required certain scientific understandings. For example, the activities included snorkeling, exploring lava fields, fish identification, meteorite classification, etc. Based on the reported research above, such authentic situations should lead to increased meaning and retention of information as well as increased confidence in the subject (Lave & Wenger, 1991). Finally, many teachers said they were new to one topic or another at the beginning of the trip, but they became more confident in these new fields as they developed

throughout the course, and moved toward the center of the “community of practice” (Korthagen, 2010; Lave & Wenger, 1991).

Teacher Learning and Professional Development

The term “professional development” describes intensive, ongoing teacher preparation throughout teachers’ careers that enhances learning and school environments (Fenstermacher & Berliner, 1985; Elmore, 2002). In the National Science Education Standards, the National Research Council explains that there are four main standards for teacher professional development: (a.) teachers should learn science content through inquiry-based techniques; (b.) teachers’ professional development should be an integrated balance of science knowledge, pedagogy, and the application of that knowledge; (c.) professional development should build upon teachers’ existing understandings and support teacher lifelong learning; and (d.) programs should be coherent and integrated with other subjects and disciplines. (55-74). Susan Loucks-Horsley, Katherine Stiles and Peter Hewson (1996) added to this list in their synthesis of professional development standards. They explain that professional development should be “driven by a clear, well-defined image of effective classroom learning and teaching; ...use instructional methods to promote learning for adults which mirror the methods to be used with students;...build or strengthen the learning community of science and mathematics teachers;...prepare and support teachers to serve in leadership roles;...provide links to other parts of the educational system;...[and] include continuous assessment” (1-3). Kennedy’s (1998) research supports this pattern by demonstrating how experiences that center on content knowledge and knowledge of students tend to have a greater impact on student learning than others that focus only on teaching behaviors.

However, many professional development programs fall short of this mark. As Chval et al. (2007) explain, professional development programs need to consider teachers' prior knowledge and personal needs in order to be truly effective. They examined the experiences of middle and high school science and mathematics teachers' experiences in professional development programs. According to their research, teachers participate in minimal amounts of professional development and there is an unfortunately large disconnect between teachers' needs and their experiences in the programs. As a result, they suggest that professional development coordinators seek out teachers' input prior to the start of their programs in order to better meet the educators' needs.

In addition to teacher input, other characteristics of workshops foster increased teacher learning. For example, Weiss, Banilower, McMahon, & Smith (2001) explain how the "one-and-done" format of a workshop is the most common form of professional development, and these disconnected, decontextualized formats typically do not match teachers' needs (Bransford, Brown, & Cocking, 2000). In general, Ball and Cohen state, "Teacher learning has traditionally been a patchwork of opportunities—formal and informal, mandatory and voluntary, serendipitous and planned—stitched together into a fragmented and incoherent 'curriculum'" (as cited in Wilson & Berne, 1999, p. 174). When well-planned and implemented, professional development programs can impact teachers in not only their content knowledge, but also their personal enthusiasm and self-efficacy (Fraser-Abder & Leonhardt, 1996; Stock, 2010).

Garet, Porter, Desimone, Birman, and Yoon (2001) explain, in order to foster significant educational change, professional development programs must have a strong focus on content knowledge, provide opportunities for active teacher learning, and have a coherence or connection with teachers' other learning activities. In their nationwide survey of teachers, they found that

certain structural features of professional development programs have significant implications for teacher learning. For example, increased duration and extended contact with participants over a series of weeks or months facilitates much more effective teacher learning than a workshop that lasts only a day or two. Additionally, teachers who attend professional development courses in teams include more learned material in their classrooms than those who attend workshops alone.

The Project ISLE instructional team took the work of Garet et al. (2001) into careful consideration when planning the program as well as other model programs. For example, Pop et al. (2010) investigated the “teachers’ motivation, expectations, and changes” of 67 teachers following a 6-week summer professional development program known as Research Experiences for Teachers (RET). Their work demonstrates the value of science teacher learning programs that foster strong “real life science” or research experiences. They explain, overall “...teachers were intrinsically motivated to participate in the RET program, were able to construct new knowledge through inquiry, and were able to apply the research experiences outcomes to their classroom teaching” (143).

Professional Development

Professional development opportunities frequently set out to instill or alter teachers’ beliefs, but such tasks are not easily accomplished. Similarly, if researchers are trying to understand how teachers change their beliefs, they may be faced with further complications due to their steadfast nature. Typically, beliefs established early in life tend to be stronger than those constructed more recently. Pajares (1992) explains,

...the earlier a belief is included into the belief structure, the more difficult it is to alter, for these beliefs subsequently affect perception and strongly influence the processing of new information. It is for this reason that newly acquired beliefs are most vulnerable. With time and use, they become robust, and individuals hold on to beliefs based on incorrect or incomplete knowledge even after scientifically correct explanations are presented to them (317).

For example, Fetters et al. (2002) attempted to understand elementary teachers' attitudes and dispositions in a summer professional development institute about inquiry. Specifically, they studied how the institute affected teachers' beliefs, how the teachers implemented the institute's material throughout the academic year, and whether their beliefs about teaching science, scientists, or effective instruction helped or hindered the implementation of inquiry. They found that teachers were resistant to change largely because the teachers expressed feelings of being overwhelmed with material and information, which led to anxiety about teaching inquiry. The study concluded that in order to foster changes in elementary teachers' beliefs about inquiry, educators require a highly supportive learning environment in which they have opportunities to be both student and teacher with a balance of content and pedagogical practice. However, such supportive environments still may not be enough. As Simmons et al. (1999) explain, changing teachers' feelings or personal behaviors toward a subject may not be enough to foster changes in classroom practice.

Implications for the Present Study. Of the four principles of professional development described by the National Science Education Standards, Project ISLE met three of them fully and met the fourth standard partially. For example, the other Project ISLE instructors and I made every effort to include a balance of content and pedagogy into the program; we surveyed the teachers prior to the program so that we could build on their existing understandings; and the program was interdisciplinary with multiple scientific and social topics. Several of the activities

met the fourth standard of inquiry based learning, but some activities were more traditional in delivery format (see also Chval et al., 2007). The extended nature of the program far exceeded that of the traditional “one-and-done” workshop, which also increases the potential for effectiveness (Weiss, Banilower, McMahon, & Smith, 2001). Furthermore, the Project ISLE co-instructors took the work of Garet et al. (2001) into careful consideration when planning the program. As a result, we took several steps from the outset to strengthen the program including: requesting teams of teachers to apply, encouraging administrator participation, and seeking out a blend of novice and experienced teachers. An understanding of the program’s effectiveness based on this research gave me insight into the program as a whole and the potential for teacher impact on both conceptualizations and classroom inclusion.

Professional development programs often set out to change or alter teachers’ beliefs. The Project ISLE program did not set out to cause dramatic changes in teachers’ perceptions, but rather to assist them in their science content knowledge. Still, I took careful note of any changes in teachers’ beliefs or conceptualizations that occurred. An example of a program that hoped to alter teachers’ views was described in Fetters et al. (2002). Although the goals of Project ISLE were very different than this program, the amount of information teachers received in Project ISLE mimicked that of the professional development experience. Also, like the Fetters et al. study, half of the Project ISLE teachers were elementary teachers who were also the only participants to express feelings of being overwhelmed. On the other hand, elementary teachers may view the subject of ocean literacy as less of a threat to the status quo of their classrooms than inquiry. In other words, the findings of Fetters et al. inform the data concerning teachers’ reactions to the material and curriculum.

Socioscientific Issues

Socioscientific Issues (SSI) are scientific dilemmas discussed in social settings that center around inconclusive topics that have divided the greater scientific community or public at large (Sadler, 2004; Kolstø, 2006). Due to their unresolved nature, when having a discussion involving SSI, individuals must utilize their prior knowledge and implement ethical reasoning skills in order to choose a position with regard to the issue (Sadler, 2004). Throughout the course of a school year, teachers frequently face controversial, scientifically-based issues on their classrooms, which teachers may handle in different ways. However, despite minor differences in classroom management of SSI, there is a degree of consistency among educators with regard to their beliefs about SSI in the classroom. For example, teachers want to discuss SSI issues, but many hesitate due to concerns about indoctrinating students or unknowingly impressing their personal views of the issue onto the class (Cross & Price, 1996). Sadler, Amirshokoohi, Kazempour, and Allspaw (2006) investigated this concern in their study on teachers' perspectives on SSI and science instruction. Their work revealed five approaches that teachers take toward SSI and organized those into the following profiles:

1. Teachers that embrace SSI and include them in their classroom instruction regularly,
2. Teachers who want to teach SSI but believe they are unable to do so due to various constraints,
3. Teachers who did not like the idea of committing time to SSI instruction,
4. Teachers who did not believe values or ethics had a place in science education, and
5. Teachers who believed ethical development was a crucial aspect of all students' education.

Implications for the Present Study. Many of the issues addressed during Project ISLE involved SSI and how teachers could include such topics in their classrooms. Additionally, several of the principles within ocean literacy have strong SSI undertones including global climate change, habitat destruction, and the interconnectedness of humans and the ocean. Although this study did not focus specifically on the implementation of SSI, an understanding of SSI was useful for framing my research and data analysis, and the five approaches cited in Sadler et al. (2006) helped me understand how my participants approach SSI issues within ocean literacy.

Conceptual Framework

In addition to the theoretical research, I also reviewed literature that would help me understand the concepts forming the foundation of ocean literacy: scientific literacy and environmental education. Due to a limited amount of research available concerning ocean literacy, the parameters with which I chose literature were somewhat broad. For example, the concept of ocean literacy cannot be fully understood without a firm understanding of its roots in environmental education. Therefore, the first part of this review includes a brief description of a few influential works that would give me a better understanding of those key factors. Additionally, to better understand the type of professional development program for which I was participant/observer, I investigate experiential education research and describe their potential impact. Finally, literature concerning environmental education professional development emphasizing experiential education shed light on best practices, barriers to implementation, and potential effects on teacher instruction. I conclude this section with an explanation of how these ideas come together to form my personal definition of ocean literacy.

Ocean Literacy and Scientific Literacy

First, ocean literacy scholars argue that a person cannot be scientifically literate without also being ocean literate, and vice versa (Plankis, 2009, Marrero, 2011, Plankis & Marrero, 2010). The National Science Education Standards (NSES) define science literacy as the “knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity” (National Research Council, 1996, 22). In order to be scientifically literate, students need three things:

1. strong foundational knowledge of key concepts and processes found within the major disciplines of the Earth, Life, and Physical Sciences;
2. an intimate knowledge of the Nature of Science, or how scientists go about building upon the scientific body of knowledge; and
3. The ability to use scientific information in their daily lives and refine it by making linkages between key concepts, cognitively organizing new information with old, thus enabling them to be lifelong learners (NRC 1996, Bybee 1997, Gallagher 1997).

In other words, full science literacy includes multidimensional knowledge of the sciences and an ability to apply that knowledge in everyday life. Since ocean science is innately interdisciplinary, one cannot be scientifically literate without having a strong ocean literacy as well (Plankis, 2009, Marrero, 2011, Plankis & Marrero, 2010).

Ocean Literacy and Environmental Education

As mentioned previously, Ocean literacy is defined as “an understanding of the ocean’s influence on you and your influence on the ocean” (National Geographic Society et. al., 2006). This knowledge is intended to lead to awareness and advocacy for ocean ecosystems to improve their overall health. Similarly, according to Hart and Nolan’s (1999) meta-analysis of

environmental education research, the ultimate goal of environmental education is to reconstruct society for the improvement of environmental behaviors and the protection of natural resources for future generations. In other words, the ultimate goal of Environmental education is to improve the health of the environment for the preservation of ecosystems and natural resources through education and awareness. Additionally, while almost all science instruction can improve science literacy, not all science curricula improve students' environmental literacy. Since the ocean environment is such a main part of ocean literacy, I investigated literature concerning teacher professional development and inclusion of environmental education.

Experiential Environmental Education Professional Development

Ocean literacy is a branch of environmental education, and its ultimate goal is to reconstruct society for the improvement of environmental behaviors and the protection of natural resources for future generations (Hart & Nolan, 1999). Hart and Nolan's meta-analysis of environmental education research, explains how most teachers seem willing and interested in including environmental science into their classrooms, but feel unprepared or unsupported to do so. Additionally, according to the UNESCO-UNEP Congress in Environmental Education and Training (1988), teacher preparation in environmental education is a major priority.

Environmental education professional development can take place in a variety of settings, but these lessons take on an especially powerful form when they take place outside of the traditional classroom where students are active participants in their learning. Such instruction describes Experiential Learning. According to Seed (2008), Experiential Learning is when "individuals create knowledge through the transformation of their lived experiences" (210). In other words, by providing hands-on learning, experiential education helps students bridge the gap between disconnected classroom learning and real-life knowledge application (Eyler, 2009).

Professional development opportunities should include a balance of pedagogical methods and hands-on experiences (Orr, 1992). Robottom (1987) explains that environmental education professional development opportunities should be: (a) inquiry-based and challenge teachers to problem solve; (b) participatory in nature; (c) critical of educational values and assumptions; (d) involve teachers in real-world problems; and (e) encourage teachers to work collaboratively with one another (Fien, J. & Rawling, R. 1996). More recently, the North American Association for Environmental Educators (2004) explained the three goals of environmental education professional development as being: “a systems approach to education, the interdependence between human and ecological systems and the importance of where one lives” (Meichtry & Smith, 2007, p. 16). However, achieving such a task is difficult. Cohen and Hill (2001) performed research on a California math curriculum and found a crucial key to success in professional development is to have sessions “in which teachers would do the mathematics themselves, talk with each other about the content, and observe examples of student work on the materials” (4). Such a structure had powerful effects on changing teacher curriculum practice.

Although a lot has changed since the 1990’s, significant barriers such as lack of content knowledge and inexperience in outdoor education still prevent teachers from incorporating the principles of environmental education (Ernst, 2009). Moreover, as of 2001, only four states required teachers to become certified in environmental education prior to becoming in-service teachers (Ruskey, Wilke, & Beasely, 2001). Similarly, a US survey of K-12 teachers found that only 10% of respondents have had training in the specific pedagogical skills required for Environmental education, so it is not surprising that teachers feel unprepared (University of Maryland Survey Research Center 2000).

Professional development programs in environmental education can help to change this pattern, and many studies have begun to look at the effects of such work. For example, Wals and Alblas' (1997) frequently cited study utilized Action Research and effectively encouraged teachers to develop an environmental dimension to their curricula by critically examining their current teaching practices (Hart & Nolan, 1999). Also, environmental education professional development programs can have unintended consequences. One study found that teachers who initially enrolled in environmental education professional development simply for stipends or graduate credit persisted in teaching environmental education in their classrooms long after the course ended (Winther et al., 2002).

Additionally, as described earlier, while traditional methods for professional development can be effective, more recent studies point to a need for experiential learning. Shepardson, Harbor, Cooper and McDonald (2002) explain that when teachers are able to conduct environmental science research in a hands-on, engaging manner, then their understandings of environmental concepts, issues, and pedagogical skills are positively affected. Just like their students, these types of learning environments force teachers to take responsibility of their knowledge development, which can lead to significant gains in understandings (Seed, 2008). In other words, strong experiential professional development programs can empower teachers to “think outside the classroom walls” and aid them in key environmental education classroom inclusion.

Implications for the Present Study

As described earlier, ocean literacy can be seen as a blend of scientific literacy and environmental education with a focus on ocean concepts. With such a view, it is important to

understand both ideas clearly before conducting ocean literacy research. For example, similar to scientific literacy, ocean literacy is designed to help students and future citizens maintain a better quality of life as a result of increased knowledge and understanding about the ocean that then lead to ocean-friendly decisions in their everyday lives (National Research Council, 1996). In this sense, understanding scientific literacy and its effects on the classroom helped me better conceptualize ocean literacy's intentions. Secondly, ocean literacy's emphasis on the human-ocean connection makes it closely tied to the principles of environmental education (Hart and Nolan, 1999). Therefore, a firm grasp of environmental education's definition, need, and usage informed my ocean literacy research by providing a framework through which to view the interconnection emphasis. Also, like the NSES principles, Project ISLE also met Robottom's (1987) standards for environmental education professional development, thus providing insight into the level of potential effectiveness. Finally, as an experiential professional development program, Project ISLE placed teachers in intensive, hands-on situations throughout the program, so understanding the effects of such experiences on students and teachers informed my analysis of teachers' behaviors and development (Seed, 2008).

Review of Literature

I am attempting to understand what teachers think of the new branch of environmental education/science literacy known as ocean literacy and how different forms of experiential professional development help their understanding and affect their teaching. To inform my understanding of experiential professional development, I conducted the following critical review of various teacher learning experiences. Since studies directly concerning marine science environmental education were limited, I begin this review of several studies that investigated professional development programs in freshwater conservation and environmental

understanding. I conclude this study with a description of the few ocean literacy studies located.

Environmental Education Professional Development Research

Klein and Riordan (2009) studied the effectiveness of professional development programs found within Expeditionary Learning Schools Outward Bound (ELS) on teacher curricula practices. The authors explain that they chose this program because of its comprehensive nature, which according to the National Staff Development Council, meets all 27 standards for rigorous professional development (Killion, 1999). Although this program is nationwide, eight teachers from five ELS schools in New York City teaching a variety of subjects participated in this study. Across all ELS schools, all teachers receive the same professional development sessions, and participate in a weeklong summer expedition where they take part in a miniature version of the types of programs ELS students perform. On two occasions throughout this year-long study, Klein and Riordan collected teachers' professional development documents, student work, and other artifacts. They also conducted two to four day-long class observations of the teachers; interviewed all of the participants four times; visited the professional development and networking activities on 20 different occasions; and recorded field notes during classroom and site-visit observations. To analyze their data, Klein and Riordan utilized Grounded Theory methodology by transcribing interviews and field notes, uploading it into a qualitative data analysis computer program (Atlasti), and synthesizing the data into codes and themes for interpretation.

Klein and Riordan found that although all teachers received the same professional training, different teachers utilized their new knowledge in different ways. In fact, "teachers' practices fell on a 'continuum of implementation,'" which began with 'No Implementation/Rejection' followed by 'Token Implementation,' 'Mistaken Implementation,'

‘Direct Implementation/Replication,’ ‘Adaptation Level I: Tinkering,’ ‘and Adaptation Level II: Crafting and Jiggering’ (69-73). Most of their participants fell in the middle of the continuum and made an effort to include some of the materials. However, one teacher believed curriculum did not apply to her classroom and refused to implement it (No Implementation/Rejection). Additionally, as a result of their observations, interviews, and subsequent Grounded Theory data analysis, they identified a model describing the four following “most significant influences on how [teachers] implemented professional development” (74).

The first major influence on curricula pertains to teacher involvement in the program. The higher level of engagement teachers have in a professional development activity, the more they will adopt the topic of their experience in their own classrooms. Secondly, Klein and Riordan found teachers’ beliefs about their content areas and knowledge can limit or encourage professional development adaptation. Similarly, teachers’ beliefs and knowledge about how to assess students using the tactics proposed in the professional development can significantly influence their implementation of the material. Finally, professional development opportunities should be differentiated to teachers needs. In other words, the “one-size-fits-all” method is not nearly as effective as a more individualized learning experience. Logically, if their needs are met, they will be much more likely to make significant gains in content and pedagogical knowledge, which will directly impact their teaching. To do so, teachers should be involved in the workshop planning process to provide suggestions for how they will learn the most information.

Klein and Riordan’s study has a lot to offer those researchers interested in experiential professional development, and their findings explain key points in the best practices of teacher learning. However, the authors examined a “best case scenario” professional development

opportunity, and the Outward Bound model does not apply to most schools. Also, some of the results may be skewed because they asked the teachers to inform them of days when they would be implementing the professional development material so they could come observe. Granted, the difficulty of observing the teachers randomly without a predetermined announcement is considerable. Still, the researchers may not have observed true representations of that teachers' implementation of the material.

Shepardson, Harbor, Cooper and McDonald (2002) also investigated an experiential professional development program in environmental education. However, unlike ESL, this study took place at Purdue and Indiana University Purdue University. Created to enable teachers to design and conduct their own environmental science experiments, this course exposed teachers to real-world scientific experiments. Each university invited a group of teachers to a series of professional development workshops. To begin, participants took part in a two day orientation where they completed a survey of a local watershed, researched community resources, and drafted a curricular integration plan. Over the summer, teachers participated in a two or three week summer institute at the universities where they worked directly with scientists to learn about water quality, sampling techniques, and technologies used to conduct environmental analyses. Also, professors in the schools' college of education coached the teachers in methods for including the material from the workshop into their classrooms. Following the workshops, teachers put their new knowledge and skills into action by conducting their own long-term water quality analyses. Additionally, teachers chose their own parameters for the analyses and created reports about their area, which they shared in academic year follow up workshops along with curricular implementation strategies.

To monitor teachers' content and skill knowledge acquisition, Shepardson, Harbor, Cooper, and McDonald (2002) gave all teacher participants a pre-assessment prior to the orientation. Following the year of training and data collection, teachers also participated in another assessment where they analyzed a hypothetical stream, selected five parameters to monitor the stream, and provided rationales for why they chose those parameters. Open ended essay questions also tested teachers' general understanding of water quality, watershed dynamics, and pollution.

The findings of this study were collected using inductive analysis where analysts identified patterns in teachers' responses. Of their numerous conclusions, some of the most significant included test scores and rationales. For example, the pre and post scores indicated that teachers' understandings of where and how to sample water quality increased dramatically, which shows a deeper understanding of the environmental science and underlying issues. Additionally, the number of reasons provided by the teachers for why they chose certain parameters to measure water quality doubled indicating that teachers' understandings of pollution sources improved markedly. Despite these gains, the authors explain that the greatest change in the teachers as a result of their experience was more of a conceptual one: "perhaps the greatest change in teacher understanding was the shift to looking at watersheds as holistic and biological systems versus stream quality as associated with individual and isolated pollutants" (Shepardson, Harbor, Cooper, & McDonald 2002, 39). In other words, because of their experience, teachers were able to see the big picture behind the environmental procedures they were performing.

Although this study provided an impressive amount of real-world science knowledge and experiences for the teacher participants, it did not describe the details surrounding how the

teachers were using their knowledge in their classroom. This leads me to believe that pedagogical methodology may not have been a main focus. Also, the program improve if teachers were required to include their students the data collection, analysis, and in the report of their findings with the other teachers.

Allen Seed (2008) took a different approach to experiential education by investigating teacher experiential professional development from the perspective of cohort building. A cohort is a group of learners that start and finish a program at the same time and build strong professional relationships designed to support one another in years to come. For this study, middle school math and science teachers participated in a University of Memphis' program called Recruitment and Retention through Reinvention of Teacher Education (3 R's) located in a in north central Arkansas. This learner centered approach, caters to teachers' various cognitive styles and encourages reflection in conjunction with the professional development activities (Miettinen, 2000, Seed2008). The question guiding their research was: "What perceptions do students and faculty have of an experiential learning-based, cohort-building experience?" (Seed 2008, p. 215). Twelve pre-service teachers were recruited by the 3R's program for this study, along with three faculty members from the University of Memphis and one of the authors of the article. The data sources included small group interviews and email questionnaires. The questions in both of these data sources concerned the participants' views of: the main benefits of the program, any concerns they had about the experience, and their thoughts on the essential components of the workshop.

Data analysis began with the transcription of interview data. Seed (2008) then examined interview data along with the surveys for emerging themes using Grounded Theory methods. Based on the data Seed provided, the central themes of the investigation coordinated closely with

the questions participants were asked: the benefits of the program, concerns, and program essentials. First, in terms of program benefits, cohort members listed building relationships within their cohorts as among the biggest benefits. Also, teachers said that observing the 3R's faculty served as a useful model for them. Next, participants' concerns included the length of the experience, the timing of the program right before the beginning of school, and the overwhelming amount of information they received during the program. The isolation of the program location was seen as essential to most participants because it forced them to open up and bond with their cohort members. As a result, the participants developed close relationships with one another. Such a cohort designed to be mutually supportive and encouraging, can prove to be an extremely valuable resource for the challenges they will inevitably face in their first years of teaching. Also, because of the experiential nature of this experience, teachers were able to "explore personally meaningful concepts derived from their own history and make connections between experience and learning" (Seed, 2008, p. 222). In other words, this study nicely reinforced the importance of community and cohort building. However, as the participants pointed out, the workshop or retreat was held right before the first day of school, so participants were distracted with their impending obligations and responsibilities. Had the timing of the experience been different, the participants may have been able to relax more and possibly garnered increased benefits for that challenging first year of teaching.

Success in teaching depends in part on a teachers' self confidence. Meichtry and Smith (2007) investigated teachers' confidence, attitudes, and classroom practices as a result of a 'place-based' professional development experience. The theory behind "place-based" teaching is that if you know and understand the place in which you live, you are more likely to want to protect its resources, cultural history, and environment. After a rigorous application process, the

authors selected twenty teachers from nineteen counties in the Ohio River watershed area to travel 310 miles from the headwaters down to the official start of the Ohio River over a six day summer workshop. Only teachers from schools located within the watershed for this river took part in this experience in order to reinforce the “place-based” philosophy. The objectives for the program were to increase teachers confidence so they can better use inquiry based learning, integrate science, do interdisciplinary units, take advantage of community based resources and the local environment, include real-world issues, use scientific technologies, conduct field work, and teach students about watersheds.

While traversing the river, teachers assessed the river’s water quality along 10 sites and performed biodiversity assessments with macro-invertebrate indexes and fish surveys. Teachers also participated in two follow up sessions in the academic year following the field experience. Teachers’ confidence level, attitude toward the environment, and classroom practices were assessed to see the impact of the professional development course. Data sources included a pre-departure content test, a posttest on the last day of the program, and long-term posttest nine months following the program’s conclusion to assess long term impact. Each assessment included five point Likert-type scale of confidence, questions designed to determine program goal achievement, an environmental attitude assessment, and other questions concerning teachers’ usage of materials and procedures from the workshop. They analyzed the data using statistical methods including Cronbach’s alphas and a MANOVA test.

Meichtry and Smith (2007) list three main findings that coordinate with the stated assessment goals. First, teachers’ confidence increased significantly, especially teachers’ confidence and ability to utilize community resources. Also, the authors noted that some gains were not significant after the first posttest, but became significant in the long term posttest once

they had utilized the material in their classrooms. For example, using technology and connecting science to the real-world were two items included among the long-term benefits. Similarly, the course assessments indicated that teachers' classroom practice changed significantly in terms of the utilization of community resources, inclusion of field investigations, teaching of watershed topics, and the connection of real-life to science. Teachers' environmental attitudes also showed significant improvements in the post-assessments.

The Ohio River program seems as if it was an incredible experience for teachers that really opened their eyes to the world of science in a way that no lecture ever could. However, I think the program could be strengthened in a number of ways. First of all, it seems as if the program had too many course objectives (9 total, listed earlier). Since the main part of program was only six days, focusing on the two or three of the most important objectives may have increased teachers' deep level knowledge acquisition. Additionally, I think a better understanding of teachers' attitudes and behaviors would be understood more fully with the usage of qualitative research methods.

Professional development courses in environmental education are especially challenging to assess because they have such varying learning goals that include the understanding of new science content, social context issues, and effective pedagogical skills. To help me understand this form of evaluation, I reviewed Barbara Wood's (2001) article concerning the usage of the Stake's Countenance Model (Stake, 1977). This model is a framework for evaluating complex situations using quantitative and qualitative methods that "draws attention to the differences between descriptive and judgmental acts according to their phase in the educational program: antecedent, transaction, and outcome" (Wood, 2001, 19). Wood utilized this model to evaluate an experiential education professional development opportunity known as The Chesapeake

Watershed Ecology course. Although it is not completely clear, it appears as if all of the participants came from the same school district. Wood explains, “The school system requested this highly concentrated schedule to accommodate the limited time available for teacher training” (2001, 20). Therefore, it sounds as if this course may have been a mandatory learning experience. Still, the teachers participated in what sounds like a high quality science experience.

The Chesapeake Watershed Ecology course educates teachers in the research and pedagogy of their community environment. Over a two-week period, teachers participated in a series of lessons on experimental design, map orientation, deep water monitoring techniques, identifying biological indicators, wetland delineation, internet resources, and instructional sequencing. Additionally, the Stake’s Model compared course goals and objectives to three main features designed to identify discrepancies between course intentions and outcomes. The first of these features included program antecedents like teacher background, appropriate curriculum, and resource availability. Secondly, Wood also considered the program’s “transactions” such as component participation, behavioral interactions, and course choreography. Finally, Wood assessed the program’s outcomes by investigating teachers’ performance, attitudes, intent to use the material, and any unexpected outcomes of the course. The data sources for this assessment included pretests, posttests, teacher surveys, expert questionnaire, journals, and various other sources.

Wood’s use of the Stake Model indicated that 9 of the 10 course features exceeded the criteria standards within the judgment matrix of the model. For example, the course ran smoothly, teachers remained actively engaged throughout; the course satisfied all objectives; and teachers described their experience as meaningful and planned to use the material in their classrooms. However, in the category of “unexpected outcomes,” Wood found more negative

items than positive. For example, teachers voiced their administration as a barrier to the inclusion of their new material, which was not anticipated by the course creators. Also, the long class days prevented teachers from being able to work with their peers to brainstorm and absorb the material.

The final professional development opportunity I reviewed was very different from the other studies reviewed. Fien and Rawling's (1996) study took place in Griffith University in Queensland, Australia. Instead of examining an informal professional development course, Fien and Rawling took a close look at graduate students' experiences in a 'Master of Environmental Education' degree program. Created to teach educators objectives and strategies necessary for environmental education, this program provides an experience that awakens "environmental educators to the social-change objectives of their field and empower them to be active, critically reflective practitioners in their chosen profession" (Fien & Rawling, 1996, 2). The program designers used Robottom's five principles for professional development in environmental education in the formation of the Griffith Masters degree program (1987a).

Fien and Rawling's study focused on one of the four core courses: EE71006, Environment, Education and Social Change. This course placed a heavy emphasis on reflective practice as a means of uncovering deep assumptions about students' own beliefs and attitudes toward the environment. Fien and Rawling explained that the Master's program "was designed to develop that sort of reflective practitioner to work in both school-level and community-based environmental education" (1996, 6). To assess this reflective practice, Fien and Rawling performed a case study of student experiences in the Social Change course. The purpose of their study was to "increase student and faculty understanding of the reflective practice experiences provided in the course" and to determine future directions for the course (1996, 9).

The participants of this study included two different groups of students. The first group consisted of eight students from the first year the course was offered, and five students currently enrolled in the program. Participants from the first year reflected on their experience in the course the year before and explained any issues they may have had in individual interviews. Additionally, five “current” students were interviewed on a weekly basis, and two program faculty members were also interviewed. A former student from the first year program, Richard Rawling, performed the interviews to set students at ease and to increase candor. Fien and Rawling analyzed the interviews from the first group for themes, the results of which directed the interviews for the second part of the study. Due to space constraints, the authors focused on two themes within reflective practice: “the effects of the course on the experience of critical reflection and the negative personal feelings some students experienced” (Fien and Rawling, 1996, 10).

Based on the responses from the reflective portion of the study, some former students expressed a resistance to critical reflection and only one said that the reflection was impacting her work at the time of the interview. Although these students found the heavy emphasis on reflection overly time consuming and burdensome, several students said they were using the principles of reflective practice at some point in the year. On the other hand, current students provided more positive responses to critical reflection. The change in student sentiment may be due to the changes the professors of the course made between the first and second years of implementation. Regardless, students identified a range of benefits to critical reflection including: increased political consciousness; a realization of the influence and limitations of a context; increased self-confidence; and the formation of a continuing reflective practice group.

Fien and Rawling concluded that despite the setbacks in the first year of course implementation, reflection is an essential tool educators can use to research their own practice. The authors explained that reflection is especially important for environmental education because it forces teachers to identify assumptions in their teaching practices that may be inhibiting social change. Doing so allows them to “arrive at a conscious awareness of the interaction of personal and contextual factors in the creation of their personal identities and professional objectives and practices, helping them to bridge the gap between their intentions and practices” (1996, 15-16). While this may be true, the authors needed to be mindful of the feelings from their first group of students because too much of an emphasis on reflection can result in student resistance to reflection as opposed to the intent of students becoming reflective practitioners.

Ocean Literacy Research

In response to the Pew Ocean Commission (2003), researchers from Oregon State University conducted a nationwide survey of 1,233 adults in the summer and fall of 2003 to assess public knowledge of ocean science issues and determine correlates to this knowledge. Their surveys contained three indicators. First, they asked participants to respond to the question, “In general, how well informed would you consider yourself to be concerning ocean and coastal policy issues—such as fisheries, beach erosion, pollution, etc.—in the United States?” and list their personal level from 1 (not informed) to 4 (very well informed) (Steel et al., 2005, 103). Secondly, participants indicated their level of familiarity with ocean issue related terms such as ecosystem, gillnet, biodiversity, anadromous, etc. Finally, participants responded to questions concerning ocean resource issues.

The Steel et al. (2005) survey revealed a number of eye-opening facts about the US public at large. First, only about half of the population considers themselves “somewhat informed” about ocean policy issues, and a third of the country believed they are “not informed.” Their responses to the term identification and quiz questions reflected this level of information. The average number of terms known was between 4 and 5, and participants only answered an average of 2.23 questions correctly on the five question quiz. However, the findings supporting their trans-situational and situation specific hypotheses are some of the most notable. For example, they found that those living near the coast only had slightly better scores than inland participants in terms of identifying terms and answering questions. They also found that certain media have a tendency to help or harm the public’s level of ocean literacy: “In terms of how to deliver information, we found that television and radio have a negative influence on knowledge holding...Newspapers and the internet have a positive overall influence” (Steel et al., 2005, 110). Most notable, however, were their situation-specific factors concerning ocean exposure: “Experiencing coastal environments and developing environmental values bring people closer to the problems faced in coastal and ocean areas...people need to actually experience the problems before they are likely to change their views” (Steel et al., 2005, 111).

Ocean Literacy Professional Development Research

Although I located only a few studies concerning the professional preparation of teachers with respect to ocean literacy, they could still have important implications on my research. For example, Stock (2010) studied California secondary teachers’ perceptions of obstacles to ocean education in public school settings. She conducted interviews with five teachers who had experience in marine science professional development. Although all of her participants believed ocean education to be important, they described numerous obstacles to implementation

in their classrooms, including high stakes testing and lack of time. Stock also found that teachers' ocean literacy improved as a result of their professional development, and they were left with a desire to share this knowledge with their students. She explains, "Students respond well to the "wild and weird," and connect to ocean content as it relates to animals, making a great launching off point for many content standards to revolve around" (29). She also reported on teachers' general reactions to the programs they experienced:

The teachers commented on the value of professional development and how excited they are to interact with "experts in the field" such as scientists or management agency personnel, such as within national marine sanctuaries...The teacher remarked how this "outside expert" is extremely important in helping the students to learn, that it's not just a textbook, but they are interacting with someone besides their teacher. Teachers also commented that their personal experiences with the ocean fuels their interest in teaching about the ocean, emphasizing the value of *in the field* professional development opportunities.

In other words, teachers place a high value on their experiences, but the amount that they can include into their classrooms is limited due to a variety of obstacles.

Gillan (2011) also studied teachers' perspectives of ocean literacy, but her research focused on educators employed in landlocked states nationwide and an examination of their textbooks. Like Stock, Gillan (2011) also reported that the biggest barrier to implementation cited by her participants were state and national standards. However, proponents of ocean literacy claim that ocean literacy does not have to be an obstacle to meeting the required standards. For example, in their nationwide analysis of the presence of ocean literacy in state standards, Hoffman & Barstow (2007) conclude with the following point: "The ocean literacy community must show that ocean literacy is comprehensive in nature and that inclusion of ocean literacy principles will not necessarily require elimination of other key science concepts" (58).

Implications for the Present Study

First, Fien and Rawling's (1996) study pointed out that reflective practice is important in all professional development, but especially in environmental education professional development. For Project ISLE, I asked teachers to keep a field journal of their notes and lesson ideas from the program activities (Leslie & Roth, 2003). Similarly, as Seed (2008) pointed out, the formation of cohorts gives teachers power to include what they learned and enable them to share resources and ideas. This research is the reason why we requested teams of teachers from individual schools to apply to Project ISLE. Seed's participants stated that they felt overwhelmed by the amount of information they received. Wood's (2001) study also reinforced the fact that it is important not to try and accomplish too much in a short period of time. Project ISLE participants also received a non-stop flow of scientific information and some described feelings of being overwhelmed, especially at the elementary level. However, Project ISLE was a week longer than Seed's study, and unlike the 3R's program, our teachers had multiple reflection and review sessions to help them gain better access to the material. On the other hand, Shepardson, Harbor, Cooper, and McDonald's (2002) study reminded me that while science content information is important for a professional development program in environmental education, the pedagogical processes necessary to teach the science content to teachers' students are equally crucial. To address this concern, Project ISLE teachers brainstormed lesson plan ideas on three different occasions after teachers' lesson sharing time. Meichtry and Smith's (2007) study reinforced the importance of qualitative research methods in environmental education. I utilized qualitative methods in order to get a more accurate understanding of teachers' conceptualizations and classroom inclusion of the ocean literacy material found within

the program. As mentioned previously, Meichtry and Smith should have performed field and classroom observations to improve this area of their research.

Finally, Klein and Riordan's (2009) "four most significant influences on how teachers implemented professional development" was extremely helpful (Klein and Riordan 2009, 74). For example, they explained that the more engaged teachers are, the more they will bring back to their classrooms. Also, another "most influential" item from Klein and Riordan's research concerned course differentiation. To review, they explained that the more a course meets individual teachers' needs, the more they are able to learn. Project ISLE applicants each answered an essay question describing what they hope to get out of the experience, thus helping us tailor the experience to participants' individual needs.

Klein and Riordan (2009) explain that "high quality professional development grounds teachers in both pedagogy and content, offers them opportunities to practice those areas in contexts similar to their classrooms, is sustained over time, offers a community of peers and coaches that provide support and opportunities to collaborate, and is resource rich" (p. 63). The experiential marine science professional development program I studied for this research also possessed these strong qualities. Other aspects of the program were more inquiry based, and teachers worked directly with scientists to conduct surveys of invertebrate or fish species biodiversity. Finally, all of the activities were balanced with pedagogical emphases through teacher led lesson sharing, brainstorming sessions, group reflections, and unit planning times. The research described above also mimics the qualitative nature of my study including data sources such as pre- and post-program surveys, field note observations, and in-depth interviews.

In terms of the ocean literacy literature reviewed, several of their findings have important implications on this research study. For example, the work of Steel et al. (2005) supports the need for research such as this. Their findings describing the glaring lack of ocean knowledge within the American public point to the deficit of ocean education within our schools, and the need for additional teacher preparation in this area. Moreover, their conclusions concerning the effects of “experiencing coastal environments and developing environmental values” bringing people closer to the ocean and changing their views about ocean stewardship are encouraging (111). Next, although Stock’s (2010) study was limited by a small sample size ($n=5$), and although she did not attend the professional development experiences with her participants, her data and the data of Gillan (2011) informed my research concerning Project ISLE’s classroom inclusion by providing an understanding of their participants’ perceptions of barriers to ocean literacy implementation.

Hawai`i as a Context for this Study

Hawai`i is a unique learning contextual environment that can have a lasting effect on anyone who visits. For this reason, and because Project ISLE included a number of native Hawaiian cultural experiences, the following is a brief discussion of the Hawaiian culture’s past and present as a context for a study about ocean literacy.

Hawai`i is ideal to study ocean literacy due to its location in the Pacific Ocean and the culture of its inhabitants. First, as Cameron (1987) explains, the Pacific’s massive size is almost difficult to comprehend: It stretches 9200 miles from the Bering Strait to Antarctica and spans 10,400 miles at the equator. What’s more, the other four oceans on the planet could fit within the boundaries of this vast body of water. Also, with the nearest land being 3500 miles away,

Hawai`i is recognized as the most isolated land mass in the world (Simon et al. 1984). Such isolation and such close contact with the ocean on a daily basis can have a tremendous effect on the lives and developing cultures of island settlers. This may be one reason why the indigenous people of Hawai`i traditionally exude a love and reverence for this ocean. Moreover, it is logical to assume that such a reverence would be necessary for survival on such isolated landmasses. As D`Arcy (2006) explains, marine ecosystems are dynamic and constantly changing. These changes result in short term weather disturbances as well as long term climate or seasonal patterns that can severely alter a people's way of life. Therefore, D`Arcy explains that people living in such dynamic environments must pay close attention to the signs the ocean provides and be able to make quick changes and adjustments, which fosters "expectations of unheralded elements intruding from beyond the horizon, curiosity about where these elements came from, and flexible, opportunistic strategies to cope with this, at times, uncertain world" (13).

Understandably, those who live in more stable environments, such as those on large continents away from water, do not develop such a fine-tuned sensitivity to the marine environment.

D`Arcy goes on to explain, "The rhythms and currents of this oceanic environment link Polynesia and Micronesia. The sea dominates the lives and consciousness of the inhabitants of both areas as nowhere else on earth. In this ocean setting, the sea cannot be ignored" (26.)

Hau`ofa's (1994) views of his people mirror those of D`Arcy's: "for us in Oceania, the sea defines us, what we are, and have always been. As the great Caribbean poet Derek Wolcott put it, 'the sea is history'" (392; See also Wolcott, 1986). Hau`ofa goes on to explain this view of the ocean as a source of history:

...the world of our ancestors was a large sea full of places to explore, to make their homes in, to breed generations of seafarers like themselves. People raised in this environment were at home with the sea. They played in it as soon as they could walk

steadily, they worked in it, they fought on it. They developed great skills for navigating the waters, and the spirit to traverse even the few large gaps that separated their island groups. Theirs was a large world in which peoples and cultures moved and mingled, unhindered by boundaries of the kind erected much later by imperial powers (148).

For native Hawaiians, these views translated into a mixture of spiritual beliefs and practical knowledge. For example, indigenous Hawaiians viewed the sea as a home for deities, spirits, and ancestors. However, their backgrounds as maritime navigators and fishers also gave them extensive practical knowledge. Minerbi, McGregor & Matsuoka (1993) point out that Hawaiians possessed the most complete understanding of the ocean in the nineteenth century. Their level of detail to their knowledge of the surrounding reefs and lagoons was unparalleled among island peoples. Even more remarkable, ethnographers discovered their knowledge of deep waters was almost as good as shallow areas with detailed descriptions of topography and fauna as far down as 200 fathoms (Hommon, 1975).

Unfortunately, this rich traditional knowledge has lessened since the colonization of Hawai'i. Finney (1984) comments that:

“not everyone in Hawai'i benefits from its unique marine recreation heritage. By no means can it be said today that all children of Hawai'i are amphibious. Many do not know how to swim, a lot never go to the beach, and still more never experience the thrill of sailing in a canoe or any other craft. Difficulty of access to the sea from underprivileged urban areas; lack of funds to buy surfing equipment, much less a small catamaran or even a windsurfer; a lingering continental, land-orientated world view that affects both personal preferences and government priorities; and a market-dedicated land-development syndrome combine to keep an entire range of the population from achieving that joyful communion with the sea that is the Polynesian maritime heritage” (191-92). (As cited in D'Arcy, 2006, 167).

Wilson (2000) speculates that the shift away from their oceanic heritage is a result of Western views of the ocean strongly influenced by works such as Herman Melville's (1851) *Moby Dick*,

which anticipated the US perspective of the ocean as “a source of raw material and cheap labour, ‘an ocean American plantation’, the whaling ship as ‘factory’ exploiting an ‘international division of labour’ (38).

On the other hand, within the past 100 years, Hawai`i has experienced a renaissance of the traditional Hawaiian culture. Native Hawaiians began to challenge the views of the ocean as a plantation waiting to be exploited (Najita, 2003). Such a challenge came about at least partially because of the resurgence in traditional religious and ancestral beliefs of their responsibility to the land:

Hawaiian identity lies in a genealogical relationship to *`aumakua* (ancestral spirit), *`aina* (the land), and *kanaka* (other Hawaiians). Hawaiians are linked through *`aumakua*, ancestral spirits, and through *makua*, our parents. Hawaiians have a responsibility to *malama* the *aina* (care for the land), and the land thus cares for us. Our genealogies explain our relations to other Hawaiians and—most importantly—where we came from (Hall, 2005, 405).

This feeling of responsibility inspires modern day Hawaiians to educate their children about their cultural heritage and fight for the protection of certain natural areas. Hall (2005) explains, “We are Hawaiian at heart, history, and bone, in ancestor and child” (412). The popular Hawaiian traditionalist, Moke Kupihea(2001) who warned fellow Hawaiians, “The past does not disappear, it is merely silenced” and Hall agrees by saying, “As contemporary Hawaiians we are charged with filling that silence because others are too willing to fill it for us” (Hall, 2005, 412; Kupihea, 2001, 214).

Implications for the Present Study

The cultural history of Hawai`i and location as the most isolated land mass in the world (Simon et al., 1984) make Hawai`i an ideal site in which to study “an understanding of the

ocean's influence on you and your influence on the ocean" (National Geographic Society, et al., 2003). Almost all of the speakers recruited as guest lecturers and activity leaders in Hawai'i included at least some sort of tie into the cultural and historical heritage of the activity to the native heritage, thus putting these sentiments at the forefront of the participants' minds. According to Semken (2005), such location-focused teaching coordinates with the educational trend known as "sense of place" or, "the meanings of and the attachments to a place held by a person or a group" (149; See also Cajete, 1994; Gruenewald, 2003). By infusing Project ISLE with place-based instruction, the teachers received scientific and pedagogical instruction that promoted a more sustainable lifestyle in both their personal lives and professional classrooms (Semken, 2005).

Summary of the Chapter

In conclusion, several bodies of knowledge and educational theories came together to inform the theoretical framework of this research. I used my understanding of teacher beliefs to help me interpret teachers' conceptualizations of ocean literacy before, during, and after Project ISLE's implementation. The literature surrounding situated learning informed the potential implications of the program on teachers' learning, ocean literacy development, and future classroom practices. Similarly, my review of professional development literature helped me understand the overall effectiveness of the program based on the program design and implementation. Finally, understanding theories surrounding socioscientific issues and how teachers approach such issues in their classrooms informed my interpretation of teachers' classroom inclusion of ocean literacy material from the program.

My conceptual framework for this study detailed how ocean literacy could, arguably, be viewed as a combination of science literacy and environmental education focused on ocean topics. As discussed previously, one cannot be fully scientifically or environmentally literate without also being ocean literate because of the multidisciplinary nature of oceanography (Plankis & Marrero 2010). Additionally, experiential education is a highly effective way to foster this literacy because it fully immerses the student in the learning experience. Teachers cannot adequately lead students to science or ocean literacy without first being literate themselves. Therefore, marine science experiential professional development opportunities can provide teachers with the foundation they need to foster effective ocean science learning experiences for students.

Numerous environmental education, experiential learning, and ocean literacy professional development opportunities came together to form a foundation for this study in my review of literature. The environmental education programs provided best practices and potential impacts of professional development designed to foster environmental stewardship. The work in experiential learning reinforced the value of the intensive, hands-on work teachers experienced during Project ISLE. The few studies located pertaining specifically to ocean literacy professional development informed my data analysis of teachers' perceptions toward ocean literacy and what they believe to be the barriers to classroom implementation of marine science and ocean stewardship material. Finally, the research concerning the native Hawaiians' unique cultural perspectives toward the ocean provided a framework for the potential implications of this exotic location on teachers' perceptions of ocean literacy.

In the chapter that follows, I describe the methodological steps taken for this study. First, I provide a background for the study by detailing the pilot study conducted in the summer of

2010 as well as the various procedures implemented as a result of stipulations within the funding agency for the Project ISLE program. Next, I explain the methods used to collect and analyze the data including participant selection, instrument implementation, and in-depth analyses of data sources.

Chapter 3

METHODOLOGY AND METHODS

Introduction

The following chapter details the theoretical methodology supporting this research study and the methods utilized to collect, analyze, and interpret data in the context of Project ISLE, a grant-funded professional development program in Hawai'i. As a co-author and co-instructor of the program, my role in the data collection was that of participant-observer and leader. The following explains the context of my study with regard to a pilot study from the summer of 2010, the process of the formation of Project ISLE, as well as the methods of data collection before, during and after the implementation of the program. Finally, my methods for data analysis and interpretation of my findings are described at the conclusion of the chapter.

Methodology

This study attempts to understand teachers' conceptualizations and classroom inclusion of ocean literacy following an intensive marine science professional development experience. Qualitative research methodologies were a necessary and integral part of my research questions concerning teachers' conceptualizations and teaching habits of ocean literacy. I formulated all of the eight data assertions (see Chapters Four and Five) using the qualitative methodologies described in this section. However, some quantitative methods were included in the beginning of my research study in an attempt to better understand my participants. Quantitative

methodologies utilized included pre- and post-assessments and Likert Scale survey questions generating non-parametric data. Due to the fact that limited time was available in between participant recruitment and the start of the Project ISLE program (i.e., not sufficient for background interviews), I used these quantitative tools to obtain a clearer picture of the teachers' individual contexts and backgrounds prior to their Hawaiian experiences in order to envision broad pre-existing trends among the participants (Creswell & Plano Clark, 2007). However, those methods do not provide in-depth looks into the conceptualizations that teachers hold or how/why they plan to include ocean literacy lessons. Therefore, open-ended surveys, interviews, observations, and other qualitative means were used to acquire an in depth understanding of the teachers' conceptualizations and classroom inclusion of ocean literacy lessons.

To conduct this study, I utilized interpretive research as my overall methodological framework. As Erickson (1986) explains, interpretive methodology is especially useful for qualitative studies because such a format allows researchers to: "Examine (a) science classrooms as socially and culturally constructed environments for learning, (b) the nature of teaching as one feature of that learning environment, and (c) the ways in which teachers and students make sense of, and give meaning to, their interactions as the central element of the educational process" (p. 120). Similarly, Gallagher (1991) clarifies that interpretive studies attempt to explicate effective teaching in terms of student-teacher interactions. Closely aligned with my research questions, Gallagher maintains, "The researcher's intention is to learn about the teacher's knowledge, values, and beliefs as they are and not to influence teachers by his or her actions" (p. 11). In conjunction with interpretive methodology, I utilized grounded theory data collection methods (Glaser & Strauss, 1967) with constant comparative analyses (Strauss & Corbin 1998). Coordinating with grounded theorists methods, I approached my study with a general plan for

data collection but not a strict framework on which to focus my observations. Such a level of flexibility allowed me to pursue interesting side topics or investigate emerging ideas (Glaser & Strauss 1967).

Interpretive methodologies coordinate well with inductive analysis methods, which were the methods I used to analyze and interpret data (Charmaz, 2006). Specifically, I utilized two data interpretation methods to help me formulate emergent themes: line-by-line coding and focused coding (Note: a theme in qualitative research is a trend or pattern within the data that is supported by a large amount of evidence within the data.) First, in order to perform line-by-line coding, researchers must assign a title or code for each line of data. Charmaz (2006) clarifies that line-by-line coding assists the researcher in staying open minded during data analysis by forcing the researcher to examine each line individually. These codes are later analyzed and interpreted for patterns, inconsistencies, and trends. I also utilized these patterns and trends to code my data in a more focused manner. Focused coding assists researchers in arranging significant codes into meaningful categories and building accounts of observations (Ezzy, 2002). For the in-depth, detailed data sources (such as interview transcripts, surveys, and observations) I utilized both types of coding, while the less detailed sources (blogs, field notes, teacher emails, etc.) were best analyzed using focused coding. Finally, I analyzed all of the codes in order to develop emergent themes (Taylor and Bogdan, 1984). These emergent themes were later restated into data assertions (see Chapters Four and Five.)

Additionally, throughout the whole data collection and analysis processes, I systematically and creatively compared my data sources with each other. Therefore, my data analysis began very soon after I started collecting data, or as soon as a given data source was complete. In other words, once all possible participants submitted their items in a data source

(such as pre-course surveys, interviews, etc.), I analyzed the data using the methods described above for thematic analysis (Glaser & Strauss, 1967; Taylor & Bogdan 1984). Earlier data sources were analyzed first and so on, but sources were constantly revisited and compared to one another for deeper analysis. Table 3.1 is a list of data sources analyzed for this study.

Table 3.1

Data Collection Summary

Data Source	Date Collected	Number collected
1. Teacher applications	Feb 17 th - April 1 st	12 essays
2. Pre-program surveys	May 25 th - June 9 th	12 surveys
3. Teacher blogs	June 1 st - July 1 st	4 blogs
4. Pre-tests	May 25 th	12 pre-tests
5. Post-tests	June 20 th	11 post-tests
6. Fall planning forms	June 20 th	11 forms
7. Post-program survey	June 22 nd - July 31 st	11 complete post-surveys
8. Expanded field notes	June 1 st - June 21 st , Sep 15 th	22 days, 48 pages
9. Brainstorming sessions	June 9 th , 12 th , 17 th	3 group reflections
10. Lesson sharing demos	June 9 th - June 18 th	11 lesson plans
11. Teacher Field Journals	June 21 st - July 5 th	10 journals
12. Teacher units	July 21 st - August 30 th	7 total*
13. Interviews	Sept 15 th - Oct 12 th	10 interviews, 5'20'', 32'' average
14. Follow up focus group	Sept 15 th	1 group interview, 58''
15. Teacher emails	May 26 th - March 1 st	Approximately 5 per teacher
16. Classroom observation field notes	August 1 st - Dec 2 nd	Observed: 6 in person, 2 second hand*, 19 pages total
17. Pictures of classroom artifacts	August 1 st - March 1 st	32 photos
* See descriptions in narrative above for further clarification		

Methods

Description of Pilot Study

This study is a continuation and expansion of a pilot study I conducted over the summer and fall of 2010 (IRB Study # 2010-10872-0). Acting as participant observer, I attended three

marine science, professional development programs in the Bahamas, Sapelo Island, GA and St. Catherine's Island, GA. Similar to the current study, the initial research sought to understand teachers' beliefs about ocean literacy and how they describe their classroom inclusion of the material. Although the focus of the programs was not on ocean literacy specifically, the underlying messages of each were consistent with the essential principles of ocean literacy. Data sources of this initial study included pre-departure and post-program surveys of each teacher participant, field notes of the observations of teachers' activities during the programs, and three in-depth interviews with one participant from each program. The current study utilized many of the same methods, but expanded considerably upon them and included additional data sources designed to better understand classroom inclusion of ocean literacy material.

Implications from the Development of Project ISLE and Funding Grant

In the Fall of 2010, another graduate student and I decided to collaborate in writing an Improving Teacher Quality Grant funded by a University System within the southeastern United States (NCLB, Title II, Part A). Based on a program that took place between 1995 and 2005 for which Steve was co-founder, Project ISLE, was designed to strengthen urban, upper-elementary teachers' content knowledge and pedagogical skills in science teaching in an intensive two week program in Hawai'i. Steve, Seth, and myself composed the Project ISLE instructional staff. Together we wrote the Teacher Quality Grant, developed the Project ISLE itinerary, and implemented the entire program. Steve played an especially important role in this process due to his extensive expertise of the Hawaiian Islands and connections in Hawaii.

The grant required a partnership with a "high needs" school district, meaning that less than 97% of its teachers were considered "Highly Qualified" based on the standards set forth

within the No Child Left Behind Act (2001). An elementary school within a “high needs” district agreed to be our partner school after a meeting with the school’s principal and a presentation to the staff designed to assess teacher interest in the program. Project ISLE included a four part program sequence in which the teachers met for an orientation day in May, participated in the full two-week program in Hawai`i lasting from June 7-21, 2011, attended a follow up meeting in September, and allowed for an observation of their program material inclusion in their classroom practice.

Participant selection

In order to seek out highly motivated teachers willing to put forth the time and commitment necessary for the program, the Project ISLE instructional team, who consisted of Steve, Seth, and myself, created an application that included a basic questionnaire, essay, and letter of support from a member of the teacher’s administrative staff (See Appendix C). Due to the nature of the grant, the project directors chose participants based on a hierarchy of qualifications. First, preference was given to teachers employed at our partner school and other upper-elementary teachers within high needs districts within the state. After elementary teachers, middle and high school teachers who showed outstanding commitment to improving the quality of their science teaching, were also selected. In addition to the presentation at our partner school, I took a number of steps in order to recruit teachers to apply for Project ISLE, including a presentation at local science teachers’ association conference and emails sent to professional development representatives within high needs districts.

Participant Descriptions

Based on the evaluation of applications, 12 teachers were selected with six elementary teachers from our partner school, three middle grades teachers, and three high school teachers (See Participant Summary in Table 3.1).

Table 3.2

Participant Summary

	Number of Participants	Average Number of Years Teaching Experience	Number of Male/Female
Elementary	6	11.7	6 Female
Middle	3	15.7	2 Female 1 Male
High	3	5.7	2 Female 1 Male
Total	12	11.17	10 Female 2 Male

The six elementary teachers represented the only lower grade level teachers to apply, so the other applicants were considered based on their demonstrated commitment to science education. Secondary teachers selected for the program demonstrated their strong commitment in a variety of ways—teachers may have stated examples of how they used previous professional development opportunities in their classroom, showed innovative examples of current science teaching and areas where they hoped to improve, or a demonstrated a strong commitment to science professional development and improvement. Although not required, all 12 teachers admitted to the Project ISLE program agreed to participate in this study. Table 3.2 portrays a more detailed view of the participants including their grade levels taught in the 2010-2011 school

year, number of years teaching experience, and the subjects taught. If the teachers were elementary teachers, this table also portrays the amount of time they specified that they spend teaching science in a typical week of instruction.

Table 3.3

Participant Descriptions

Name	Grade Level(s)	Years Experience	Subject for 2010-11 yr (pre-ISLE)	Comments
Philip	6	10	Earth Science	Energetic and charismatic teacher. Only teacher to come alone without colleagues from his school to the program. Kept a blog of his experiences during the program. Had to leave early due to family emergency.
Amy	6 and 7	16	Earth Science	One of two Earth Science teachers from the same school. A little more hesitant about science and ocean literacy instruction than her counterpart (Lisa). Teaches in a low SES, high needs school with a high level of administrative oversight.
Alissa	9 and 10	5	Biology, Chemistry	Young, enthusiastic teacher with a passion for science knowledge. Taught forensics and chemistry in 2011-2012. Kept a blog of her experiences during the program. Taught with

				Judy and Lee.
Judy	9, 10, 11, 12	3	Biology, Chemistry	Young enthusiastic teacher with a passion for ocean science and photography. Taught oceanography in addition to the other two subjects in 2011-2012. Kept a blog of her experiences during the program. Taught at the same school as Alissa and Lee.
Lee	10	9	Chemistry	Passionate science educator who took “real” science seriously and enjoyed challenging scientific assumptions. Taught at the same school as Alissa and Judy.
Carly	4	10	All, with 10% Science	A somewhat quiet and more reserved elementary teacher who had faced significant personal problems in the 2010-2011 school year. One of six elementary teachers from the partner school.
Marie	3	8	All, with 15% Science	“Scared” of teaching and learning science. Attended Project ISLE to boost science teaching confidence. Did not feel comfortable in many of the rugged settings of the program, as described by her blog. One of six elementary teachers from the partner school.
Lisa	6	21	Earth Science	Earth Science teacher who is passionate about ocean science education and stewardship.

				Teaches in a low SES, high needs school with a high level of administrative oversight (with Amy).
Emily	1	9	All, with 10% Science	First grade teacher who has a passion for running and local Hawaiians' knowledge. One of six elementary teachers from the partner school.
Sarah	1	15	All, with 20% Science	This teacher is very enthusiastic about educational technology for her own personal learning and recording information for her students. One of six elementary teachers from the partner school.
Virginia	4	7	All, with 25% Science	Formerly a fourth grade teacher, at the partner school, this educator assumed the role of "curriculum coach" within the administration for the 2011-2012 school year.
Ashlyn	1-5 and 2nd grade "challenge"	21	Science, Math, and Language Arts (90% Science)	Serves as the "Science Lab Instructor" at the partner elementary school and sees a large portion of the students in the school in a typical week.
Average:		11.17		

Project ISLE Orientation Meeting

The orientation session for Project ISLE took place on May 22, 2011 in the College of Education at a major university within the southeast (See Agenda in Appendix D). After

introductions and a program overview, teachers learned of the products they were expected to present to the Project ISLE instructional staff during the program or upon completion of the island portion of the program. These included the Lesson Sharing presentations, field notebooks, and units. At this time, the teachers received rubrics to act as a guide in the construction of these products (See Appendix E and F). However, the rubrics were not used in the analysis of the teachers' work since a point value was not assigned and the teachers did not receive a grade for the workshop or program. Following a discussion of the rubrics, Steve and I explained the Lesson Sharing sessions to the teachers. In an effort to provide a balance of content and pedagogy during Project ISLE, we asked teachers to come to Hawai'i prepared to present a model lesson to their peers of a lesson that is "tried and true" that could potentially be used with Project ISLE material. The teachers also received a handout explaining the purpose of this assignment (See Appendix G).

Following a lunch break, I explained my dissertation research to the teachers by discussing my research questions, describing the purpose of my research, explaining the context of the pilot study leading up to this study, and reminding them that their participation was voluntary. Participants also received Consent Forms at this time (see Appendix H). Of the 12 participants present at the meeting, 8 gave me their consent forms back the same day as the orientation, 2 returned them to me prior to departure, and 2 filled out the consent forms after the program began, thus giving the study 100% participation (n=12). Following our discussion, the teachers completed their "snorkel safety check out" in which they practiced using their new snorkel gear, which they were required to purchase prior to the meeting. At the conclusion of the meeting, the teachers took a pre-test designed to assess: 1. their knowledge of basic information about the science content addressed during Project ISLE, 2. their attitudes toward the ocean, 3.

their environmental/ocean steward behaviors (recycling habits, tendency to pick up litter, etc.), and 4. their exposure to the ocean (See Appendix I). Steve constructed the knowledge component of the test based on what he remembered of the previous Project ISLE program and the speakers' presentations. The attitudes, behaviors, and exposure section were modeled after the Ocean Literacy Index (Marrero, 2011), from which questions selected and modified so as to make the questions more appropriate for adults and the content of the Project ISLE program. For example, the Index included 16 knowledge items, 14 attitude items, 11 behavior items, and 9 exposure items. Certain questions such as "Do you live near the ocean?" would not have been appropriate since all of the participants lived more than 200 miles inland. Additionally, for the purposes of this study, the behaviors, attitudes, and exposure sections were intended to provide a context to better understand teachers' backgrounds with respect to ocean literacy. While I consider beliefs to be informed by teachers' attitudes, behaviors, and exposure to a topic, these three topics on the assessments were not the primary focus of this study. To review, I am investigating teachers' conceptualizations and classroom inclusion of ocean literacy following Project ISLE. As I described in Chapter One, I view conceptualizations as a blend of individuals' understanding and beliefs about a topic.

Data Collection

Pre-Program Survey Data Collection

On May 25, three days after the orientation, the teachers received an email containing a link with the online pre-departure ocean literacy survey (See Appendix J). The survey was piloted with a group of teacher educators and science education graduate students prior to dispersal to determine appropriateness in terms of readability, clarity, etc. I revised the survey prior to

implementation based on the feedback received from the pilot group. Edited from the survey used in the pilot study, this pre-program survey provided a variety of information in four sections: 1. Biographical information (Section titled “Personal Information” on the survey), 2. Individual context of the program (“Project ISLE”), 3. Preliminary beliefs about Ocean Literacy (“Ocean Education”) and 4. Information concerning teachers’ current classroom inclusion of Ocean Literacy topics (“Current Curriculum”). The biographical questions provided basic information including contact specifics, subjects taught, years of experience, and educational background. The individual context questions provided information concerning teachers’ personal perspectives about why they applied to the program and their expectations of the program’s outcomes. Teachers explained their definitions and preliminary beliefs about Ocean Literacy in the “Ocean Education” section. They also described the role ocean science content plays in their classrooms. Finally, in order to better understand the role ocean education plays in their current classrooms, teachers described the frequency with which they use various Ocean Literacy topics by selecting one of five options ranging from “Very frequently” to “Hardly ever” or “N/A.” Ten of the 12 teachers completed the survey online prior to departure, but two teachers elected to complete a paper-version of the survey during the first few days of the program. Upon receiving all of the pre-program surveys, I compiled the data into Microsoft Word by either copying/pasting the information from surveymonkey.com or typing out written answers.

Online Archival Data Collection

Prior to departure, one teacher created a Facebook group page for the Project ISLE teachers. I utilized this medium to inform teachers of various pertinent pieces of information such as the lodging arrangements on the islands. I also provided a link to the educational blog I

kept during my travels the previous summer's pilot study. Alissa, Marie, and Judy decided to keep a blog throughout the duration of their trip. Philip also kept a blog during the first week. The teachers' blogs were submitted as data sources because their in-depth reflection of ISLE activities. Teachers' blog submission techniques varied widely. Judy and Alissa submitted reflections of activities on almost a daily basis, but their submissions were often of earlier events. Marie submitted 3-4 short entries daily on her smart phone complete with pictures of the article in question. Philip submitted entries every couple of days. His entries focused on two Leggo characters who were his "travel companions." His posts always included pictures of them in interesting situations and wrote the blog from their perspective. The entries for all of the teachers' blogs were analyzed using focused and in vivo coding.

Activities during Project ISLE

The first day of the Project ISLE program began on June 7th, 2011 at the Kilauea Military Camp within Volcano National Park on the Big Island of Hawai'i. In that first week of the program, teachers did a number of Earth Science-focused activities, including hiking through lava fields, exploring lava tubes, touring an international astronomical station, participating in Hawaiian cultural experiences, and witnessing the glow of lava at night. Toward the end of that first week, the teachers also heard lectures from members of the Hawai'i Department of Aquatic Resources while exploring a volcanic black sand beach. The Project ISLE team transitioned to Maui on June 14th, 2011. This second week of the program included snorkeling, fish identification lectures, a sea turtle conservation explanation, a behind the scenes tour of the Maui Ocean Center, a pedagogical experience with the Humpback Whale National Marine Sanctuary, a trip to Maui's dormant volcano, and a little bit of time to relax on the beach on the last day. For a full, detailed list of activities, please see the itinerary in Appendix B.

Guidelines for Teachers' Field Journals

On the first full day of the program, I stressed the importance of using the yellow field notebooks and the reasons behind their implementation. Generally, I explained the field journals were designed to help the teachers process the material and retain information. The journals were also a way for program instructors to monitor teachers' learning. I reminded teachers that we would collect the journals at the end of the program and use them to evaluate the program's effectiveness. A few teachers expressed a desire to use alternative formats to take notes such as an iPad or photos/typed reflections, and the program coordinators agreed to accommodate their requests.

Researcher's Expanded Field Notes

Throughout program activities, I recorded field notes concerning the material presented by the speakers, times, teachers' reactions/questions, and general observations including the overall mood of the activity, whether or not teachers seemed to be enjoying themselves, etc. Although I recorded most notes in the same notebook that the teachers used, some notes were typed including lesson sharing observation notes and group brainstorming notes. The handwritten notes were typed at the end of each day and expanded to include introduction, reflection, thoughts, and other pertinent information.

Teachers' Lesson Sharing Sessions

As described in the orientation section above, the teachers shared their own "best practices" lessons throughout the on-island portion of the program beginning on June 10th. On that day, I reminded teachers why we asked them to share lessons, namely that research shows that the most effective professional development has a balance of content and pedagogy with

time to reflect. I explained that we want teachers to learn from each other and share ideas because they are the experts in the classroom. The teachers then presented their lessons according to the order they chose.

Group Brainstorming Sessions

In order to foster reflective thinking and curriculum planning, Project ISLE also included three “brainstorming sessions.” Each session began with a blank word document posted on an LCD projector. The teachers all had their field notebooks in front of them, and started with a simple question, “OK, what did we do the past few days”. We then asked for teachers to “talk through” the activities and explain any questions or lesson plan ideas that they had in their notes that corresponded to the activity. As they spoke, I typed out their ideas in large font, so that everyone in the room could see it on the LCD projector. I would occasionally provide a little assistance in terms of the order of events, but I then let the teachers take over the discussion. I decided not to include the teachers’ names next to their ideas at this point because I did not want to inhibit the flow of discussion or to make it feel like this was a “data source” as opposed to an exercise to assist them in their classrooms. At the end of the first session, several teachers asked me to send the list of ideas out to them, so I forwarded the list to all of the Project ISLE participants. We followed the same procedure on two other occasions with the final one being on the last full day of the program.

Ocean Literacy Presentation

On the second to last day of the program, I pulled all the teachers aside and gave a presentation concerning the history, definition, and essential principles of ocean literacy (see Appendix K). I waited until almost the very end of the program because I did not want to

indoctrinate the teachers on what I personally felt about ocean literacy, and wanted to see how their thoughts and beliefs would develop. However, through my observations during the Project ISLE program, it was evident that some teachers were still holding on to some misconceptions about ocean literacy and that an explanation as to the basics of ocean literacy were necessary. The power point I showed them consisted of the “official” definition of ocean literacy, the purpose behind its creation, a little bit about the history of ocean literacy, a brief look into the seven principles (basically just reading what they were), and a little bit more about what it meant to be “interconnected” with the ocean (National Geographic Society et al., 2005). Since Principle 6: “the oceans and humans are inextricably interconnected,” seems to coordinate the closest with the definition of ocean literacy, I spent several slides providing examples about what ocean literacy means. I explained how humans need the ocean because of the oxygen it produces, the weather patterns, oxygen, etc. I also explained how we are all connected to the ocean through the water cycle and provided examples about eutrophication and the Great Pacific Garbage Patch. I also provided the teachers with a copy of the official ocean literacy brochure produced by the Ocean Literacy Network and we perused the matrix provided in the center of the pamphlet comparing the National Science Education Standards (NRC, 1996) to the seven Ocean Literacy Principles. Following the power point we had a brief question/answer section, which was immediately followed by free time for the teachers. The entire presentation lasted only about 30-45 minutes of the final day. Again, I did not want to impress the official definition/principles of ocean literacy upon the teachers at an earlier date because I wanted to know what their original conceptualizations were about the topic. Similarly, minimal time and emphasis was placed on the explanation of ocean literacy to avoid indoctrinating the teachers to my personal views on the subject. Additionally, since the research design focused on the effects

of the Project ISLE program on teachers' views of ocean literacy and not of the impact of ocean literacy direct instruction, I decided less of an emphasis on ocean literacy explanations would be most effective.

Participant Absence during Project ISLE

At the conclusion of the first week, one teacher, Philip, had to leave the program due to a family emergency. Although he completed a post-program survey and attended the follow-up meeting, he did not hand in a unit or field notes. Also, since he missed the bulk of the ocean literacy instruction, I decided not to include him in the interview or observation components of this study.

Post-Test, Fall Planning Forms, and Evaluations

On the final full day of the program, teachers completed a post-test of their scientific knowledge gained as well as their attitudes and behaviors from the Ocean Literacy Index mentioned earlier (see Appendix L.) Like the pre-test, the questions were modified to be more appropriate for adults. The questions were exactly the same except the exposure questions were removed since that information was not expected to have changed apart from the program itself. After the post-test, teachers completed a "Fall Planning Form" concerning their estimations for when they expected to include the Project ISLE materials in their upcoming 2011-2012 school year curricula (see Appendix M). The forms assisted me in planning teachers' observations.

Post-Program Survey

The post program survey was emailed out to teachers as a link from surveymonkey.com the week teachers arrived home from Hawai'i (See Appendix N). The survey contained 30

items, 14 of which were duplicates or modified versions of questions found on the pre-program surveys. All of the questions were open-ended responses designed to assess teachers' conceptualizations and intentions for material inclusion in their classrooms. Similar to the pre-survey, I adapted this instrument from my 2010 research study and piloted the updated version with a group of teacher educators prior to dispersal in an attempt to increase data quality.

A few weeks after dispersal of the post-program survey, I began sending follow-up emails to teachers who had yet to respond. As a result, all of the teachers responded to the post-program survey at least in part. One teacher reported difficulty answering questions 3-8, so I sent this teacher an email with the questions posted directly in the email along with a paper copy and stamped envelope. However, her answers were never received. Upon receiving all of the post-program survey data, I compiled the data into Microsoft Word by copying and pasting the information from surveymonkey.com.

Teachers' Field Journals and Lesson Plans

At the orientation session for Project ISLE teachers each received a yellow bound notebook that was designed for recording field notes. As described earlier, teachers were expected to use the rubric provided at the orientation to record notes from activities and lectures or jot down ideas for lessons and questions they had about the material. As part of the evaluation of the program, the Project ISLE instructional staff requested that all teachers hand in their notebooks within two weeks of program completion. After reviewing the notebooks and creating digital copies of them, they would be returned to the teachers by mail. About half of the teachers provided their notebooks on the last day of the program, but others chose to submit them electronically after having scanned in the documents. In total, ten of the 12 teachers submitted

their field journals for review. The only two teachers who did not were Philip and Amy. Due to his absence for half of the program, the Project ISLE instructors decided not to require a journal from Philip. Also, despite repeated requests, Amy never responded with regard to her field journal even though she chose to participate in other follow-up data sources including the post-program survey, personal interview, and group interview follow at the follow-up meeting.

Similarly, a collection of three lesson plans was due one month after the completion of Project ISLE. The lessons did not have to be conjoined into a unit, but they did have to relate directly back to the material studied during Project ISLE. Although teachers were not assigned a grade, they were asked to use the rubrics they received during the orientation as a guide for the construction of their units. In total, I collected seven units from teachers, with one of those units being a collaborative effort of Carly and Marie. Philip, Amy, Sarah, and Virginia did not submit hard copies of units, but I observed Sarah, Virginia, and Amy's units in person at their schools, recorded copious observation notes, and took pictures of student work, bulletin boards, supplementary material, and teacher examples for later reference.

Observations

Due to the wide variety of lesson topics and grade levels observed, I decided not to use a standardized observation instrument. Instead, I utilized the same methods for classroom observations as I used while taking field notes. I arrived at least 10 minutes early for the observation, sat at an appropriate place in each classroom designated by the teacher, and typed notes concerning the set up of the classroom, what kind of posters or artifacts were around the room, etc. Once the observation began, I recorded notes concerning the students' warm up assignment; teacher introduction to the lesson; explanation of the activity; implementation;

student interactions, questions, and reactions; and teacher conclusion (if any). I also sketched a layout of the classroom including the number of students and my personal location in relation to the teacher.

The first observation was scheduled to occur on Monday, August 1, 2011 during the pre-planning professional work day at our cooperating elementary school. The six elementary teachers attending Project ISLE presented what they learned during their trip, demonstrated how the other teachers could utilize the materials, and conducted a lei-making ceremony with the faculty. Virginia, the only administrator on the Project ISLE program, took the lead in this presentation and created the power point presentation displayed for the faculty. However, due to unforeseen circumstances, the presentation was rescheduled only hours beforehand to an earlier time, so I was unable to observe the faculty's activities. When I arrived at the agreed upon time, the teachers showed me examples of their colleagues' work with the leis, gave me a sample of the taro-root yogurt they provided, and relayed stories and explanations about their discussions. I took several pictures of teachers' work to document their contribution, took field notes of their explanations, and expanded those field notes later that day.

No other issues of this sort occurred in any of the other observations. In total, I observed one full lesson from each of the eight of the Project ISLE teachers who responded to email and telephone requests for interviews. As previously described, I was unable to observe Virginia's presentation in person, but I did observe artifacts and reflections immediately after the fact. Prior to my interview with Ashlyn, I observed descriptions of Hawai'i-based lessons that she was currently implementing with her second and fifth grade students. She showed me examples of student work, explanations of how she conducted lessons, teacher artifacts, etc. I took several pictures of these items and recorded detailed field notes in the comments section prior to the

interview transcript. Therefore, I have not observed Virginia and Ashlyn in person, and I have not observed any lesson implementation for Philip. Due to his absence from half of the program, I decided not to request an observation of Philip. Table 3.4 displays a summary of the various pieces of data that I collected from the individual Project ISLE study participants:

Table 3.4
Summary of Data Collected from Individual Participants

	Pre-Assessment	Post-Assessment	Lesson Sharing Completion	Field Notebook	Unit	Pre-Survey	Post-Survey	Fall Planning Form	In-person Observation	Interview
Philip	X					X	X			
Amy	X	X	X			X	X	X	X	X
Alissa	X	X	X	X	X	X	X	X	X	X
Judy	X	X	X	X	X	X	X	X	X	X
Lee	X	X	X	X	X	X	X	X	X	X
Carly	X	X	X	X	X	X	X	X	X	
Marie	X	X	X	X	X	X	X	X	X	X
Lisa	X	X	X	X	X	X	X	X	X	X
Emily	X	X	X	X	X	X	X	X	X	X
Sarah	X	X	X	X		X		X		X
Virginia	X	X	X	X		X	X	X		X
Ashlyn	X	X	X	X	X	X	X	X		X

Personal Interviews

I conducted in-depth interviews with 10 of the 12 teachers beginning in September 2011 (See Appendix O). I utilized a semi-structured interview protocol that allowed for a significant amount of casual discussion so as to make the interviewee comfortable and “at home” during the process. The interview protocol contained 9 open-ended questions with roughly one follow up question per item. Like the surveys, I adapted the interview protocol from an instrument used in the 2010 research study, and I also piloted the instrument with a group of teacher educators in the

spring of 2011 to determine its effectiveness and appropriateness for teachers. In total, I collected ten individual interviews averaging 32 minutes each with a total of 5 hours and 20 minutes of interview data. Interview recordings were transcribed word for word beginning with an interview summary including the date, time the interview began, time the interview concluded, and reflective notes regarding the success of the interview, any interruptions that took place, etc.

Follow up Meeting and Group Interview

On the evening of September 15, 2011, 11 of the 12 total Project ISLE teachers reconvened for a follow up meeting regarding their usage of the materials, knowledge, and personal experiences from Hawai'i. The purpose of the meeting was for teachers to share how they were using the Project ISLE materials in order to get ideas for future inclusion or modify existing lessons. This session was treated as a group interview in which teachers were asked to respond to a series of questions and discuss their thoughts Project ISLE material, knowledge, and personal experience inclusion (See Appendix P for the slides used for the meeting). The main question of the interview was: How are you using the Project ISLE materials in your classroom, but I also included other questions including student reactions to information and usage of material, knowledge, and personal experiences outside the classroom. At this time the teachers also received a second consent form granting me permission to use the data from their blogs, application essays, emails, and other archival data not included in the first consent form (see Appendix Q). In total, I transcribed 58 minutes of recorded data for the group interview.

Subjectivity Statement

Due to my background and personal interests, I must acknowledge the positionalities as a researcher that inform my perspectives, which may have influenced what I may or may not have seen and collected in terms of my data. First, I am a former public school Life Science teacher, so I understand the practicalities of a traditional classroom, performing activities with young people, and traditional school contexts. This knowledge informed my observation of teachers' discussion and progression with the content of the courses in terms of their potential application of the Project ISLE material, knowledge, and experiences in their classrooms. Additionally, due to my background in marine education and passion for environmental justice, I am specifically focused on improving ocean literacy in order to improve the health of the oceans through education and awareness of oceanic environmental issues. It is possible that this knowledge may have affected my interpretation of some of the teachers' discussions or actions. Next, my role as a participant in the pilot study courses may have precluded some observations that a true "etic" researcher may have seen. Also, although the teachers knew that their participation in my study was completely voluntary, some of the participants may have decided to take part in my study based on my role as planner and instructor in the program. My role on the instructional staff may have also prevented me from seeing certain data since I was far from an "outsider's" perspective. Also, since so much of the instruction in Hawai'i was through third parties and external lecturers, my main role as instructor was a logistical one in that I was helping to make sure the program ran smoothly. However, I did conduct several short lectures with regard to marine science and conservation. Next, given that some of the teacher-participants had a good deal of teaching experience and may have considered me "less experienced" than they in terms of my career, they may have addressed me and responded to my data requests in a different way

than they would have with a more experienced and older researcher. Although I did not detect other tensions, I suppose it is possible that my gender, personal background, and professional status as doctoral student and potential teacher education professor may have influenced some teachers' responses on certain data sources.

By stating the above subject positions, I am attempting to explain to the reader what my viewpoints were during the entire research process, so that I may be "fair" in my descriptions and representations of the participants. I was not attempting to make moral judgments about teachers' opinions or beliefs, but I did utilize my own unique perspectives as a point of reference and lookout for views that may have differed from my own.

Data Analysis

The summary of data analysis methods below details the analysis of these sources based on the methods utilized for analysis. I analyzed data according to their form, so archival data (blogs, field journals, etc) were analyzed using focused coding, whereas in-depth data sources such as the pre- and post-surveys and interviews utilized line-by-line and focused coding. Following coding, I organized the data from both source types into detailed memos that included a memo title, definition, characteristics, conditions of operation, proposition, negative case(s), and illustrations. I later utilized these memos for a thematic analysis for emergent themes in the data.

Archival Analysis

The archival data that I collected from the 12 participants included their field journals, units, application essays, blogs, teacher emails, pre-tests, and post-tests. I analyzed the pre- and post-test data in two ways: I analyzed the content portion of the assessment for correctness, while

the attitude, behavior, and exposure sections were compiled into graphs and tables based on the popularity of choices selected. I used these data for contextual purposes designed to inform my research in terms of teachers' development of established ocean literacy criteria over the course of the Project ISLE program. Also, it should be noted that I did not analyze all questions of the content portion of the assessment. Due to the nature of some questions focusing specifically on astronomical phenomena, such as the color of stars, I did not think they were useful regarding ocean literacy, so those questions were excluded from the overall analysis. Except for the pre- and post-tests, I analyzed the remainder of the archival data in a similar fashion using focused coding and thematic analysis in the constant comparative method. In other words, I read each item carefully and coded the data with regard to pre-existing themes that had begun to emerge as a result of other sets of data, such as the pre- and post-program surveys. This method is in conjunction with the constant comparative method described earlier in which I analyzed data sets as they arrived and compared new data to earlier sets.

In-Depth Analyses

Certain data sources containing richer descriptions of teachers' beliefs and classroom inclusion of material were analyzed more closely than the archival data including teachers' pre-program surveys, post-program surveys, personal interviews, and the group interview. Using line-by-line coding, I analyzed these data sources closely at first followed by focused coding (see methodology section above). After this first round of data analysis, I also sorted the surveys and interview data by question and analyzed the sets again using focused coding. At this point, I also checked teachers' answers for patterns or trends in their responses and created a table for each survey/interview question listing the name and number of responses to each pattern. Finally, codes and analyses were sorted into data analysis memos.

Observation and Lesson Plan Analysis

Lesson plans, observation notes, and teacher emails regarding lesson implementation were analyzed using focused coding. Following the initial analysis, I further analyzed the data by compiling these sources into a summary table that juxtaposed their work with the required state/local standards and the coordinating ocean literacy principles. I then noted trends in the data and compared the information to existing memos of emerging themes.

Ensuring Data Quality

In an attempt to maintain the utmost quality of my data, I utilized techniques from a variety of criteria used to judge data credibility (Patton, 2002). First, I looked to traditional scientific research criteria (quantitative), which helped me to be systematic in data collection and fieldwork procedures across the three courses and utilize multiple methods as data sources. Next, I also acknowledged my subjectivity of the research subject prior to the onset of my fieldwork so as to satisfy a major aspect of the social construction criteria of data credibility. Also, since I attempted to describe the “lived experience” of the teachers while on the islands, I also utilized evocative criteria to assess my data credibility by using “thick descriptions” of their experiences (Patton, 2002, p. 545). To establish credibility of my data, I maintained prolonged contact with the teachers in my study.

In order to increase the study’s viability and trustworthiness, I took a number of steps during the data collection and analysis process. First, I maintained a detailed audit trail of all documents, procedures, and methods (Merriam, 1998). Should future researchers decide to replicate the study, then they would be able to recreate it almost exactly. Secondly, I sent out all instruments that I used in data collection to a committee of educational and science experts in

order to review and critique the documents, and I made all suggested revisions prior to their dispersal to participants. Goetz and LeCompte (1984) explain that such peer examination of materials can increase internal quality of data. Next, for every emergent theme detected among the data, I also sought out discrepant cases among the data, if any were available (Silverman, 1993). These negative cases showed exceptions or unusual situations among the data that went contrary to the emergent theme. To further increase data trustworthiness, I met with all of the participants for an extended period of time including the following occasions (see descriptions of each above): 1. The one-day orientation session, 2. The two-week program in Hawai'i, 3. Individual interviews with each participant, 4. Follow up meeting and group interview, 5. Individual classroom observations (Mathison, 1988). Finally, teachers also submitted additional information online through surveys and archival information, such as emails. Such a variety of data sources further increases viability through data triangulation (Janesick, 1994; Marshall & Rossman, 2006).

The two surveys were mostly open-ended, except for one section in the pre-program survey that contained 18 Likert Scale questions regarding teachers' usage of rephrased Ocean Literacy Essential Principles and Fundamental Concepts (OLEP&FC). Similar to the qualitative methodologies, I determined the content validity of the quantitative data sources, the pre-program questions and the pre- and post-assessments, by asking an informal group of educational and scientific experts review the material (McMillan & Schumacher, 2001). This group also checked for internal consistency and reproducibility (reliability) of the instruments (Germuth, 2007; McMillan & Schumacher, 2001). I made the suggestions the panel recommended prior to dispersal of the documents.

Risks

Throughout the data planning or collection processes, I did not anticipate any risks for participants of this study. The topic of ocean literacy is not one that is sensitive to most people, so if participants did experience any discomfort during the interviews or surveys, it was only expected to be minor embarrassment or unease. To minimize risks to participants, all personal names, official university or group titles, school names, and program locations were given pseudonyms on all tapes, transcripts, and any other documents including future publications to protect participant and site anonymities. Additionally, the results of the research, including interview and field note transcripts are available to any participant upon request. Similarly, any participant could have ended his or her involvement in the study at any time. Lastly, audio and transcribed files are stored in a locked file on my personal, password secured computer. All recordings will be erased two years after the study. Participants' permission forms are stored in a locked box and will be saved for future reference or research. Again, all future reports and publications will be void of any identifying elements found in the study, and all identities will remain strictly confidential.

Benefits

Participants received some benefits as a result of this research. I believe that teachers' involvement in this research study may cause teachers to rethink an important aspect of their classroom practice that may not have been examined previously. This research study may even inspire other professionals to create similar courses or professional development opportunities. It may also inspire hesitant teachers to seek out courses such as this, thus providing sponsors with additional qualified candidates.

Other benefits of my research study are those assisting human kind. Findings of this study will inform teachers of ocean literacy practices and ways in which they can become better teachers. It is assumed that the more teachers that become interested in the oceans and the more informed they become on the importance of ocean literacy, the more likely they are to include similar lessons in their curricula. Similarly, when students understand the many different aspects of the world's oceans, they are more likely to want to protect them. In other words, my research findings may eventually develop a new generation of ocean stewards. By protecting the world's oceans, we are also protecting an irreplaceable source of food, preserving sensitive habitats, preventing the creation of potentially harmful natural disasters such as dead zones and red tides, and helping to regulate the planet's climate by protecting Earth's best heating and cooling system.

Summary of the Chapter

This chapter has detailed the methods behind the implementation of the Project ISLE program including a description of the previous pilot study from which I developed this study. I also portrayed in detail the methodology and methods supporting my data collection, interpretation, and analysis. In total, I collected from 17 different data sources upon receipt of teachers' informed consent in May 2011 to the final observation conducted in February 2012. Data collection ended at this point because I collected all possible data by that point since the teachers who had yet to participate in an interview and/or observation were not responsive to multiple telephone or email requests. As described, I collected and analyzed data using qualitative methodologies and methods including thematic analysis, the constant comparative method, and coding.

The next chapter details the findings and conclusions of the data analyses described above with respect to teachers' classroom inclusion of ocean literacy material from Project ISLE. The data for this research question surround four main assertions: 1. Teachers' inclusion of ocean literacy based on grade level; 2. teachers' descriptions of how they are using the "real life" science from Hawai'i in their classrooms; 3. teachers' desire to share their experiences beyond their individual classrooms; and 4. teachers' self-described sense of increased morale or enthusiasm for science teaching as a result of Project ISLE.

Chapter 4

FINDINGS, ANALYSIS, AND INTERPRETATION PART I:

Teachers' Classroom Inclusion of Ocean Literacy following Project ISLE

Introduction

The first three chapters of this research study portray introductory material, relevant literature, and the methods pertaining to data collection and analysis of teachers' conceptualizations and classroom inclusion of ocean literacy following Project ISLE. The following two chapters display the findings of the study. The findings chapters are separated into two main categories coordinating with the research foci: Teachers' inclusion of ocean literacy following Project ISLE, and teachers' conceptualization of ocean literacy following Project ISLE. Further dividing these two chapters are eight assertions that emerged from the data analysis process. Grounded in extensive data from multiple sources, these assertions serve as answers to my research questions.

First, this chapter explains teachers' classroom inclusion of ocean literacy materials and information garnered from the Project ISLE program. I organized the assertions of this chapter according to the way in which teachers use various materials:

- The first theme details the ways in which teachers included the units and lesson plans they created as a result of Project ISLE. Due to the dramatically different nature of the

curricula, I examined elementary and secondary teachers' units and lesson plans separately.

- The second theme explains teachers' views on the benefits of having "real life science" experiences to share with their students. Often included as unplanned side notes, teachers' stories and pictures from their trip occur at various points in pre-existing or new lessons throughout the year.
- Next, in the third theme I describe teachers' unexpected desire to share their Project ISLE experiences with groups of people beyond their individual classrooms as well as the challenges that some teachers faced when attempting to do so.
- Finally, many teachers described a sense of revival or renewal following their experiences in Hawai'i. This increased morale with respect to their science instruction is the subject of the fourth theme in chapter four.

I conclude this chapter with a summary of the findings concerning classroom inclusion and provide an explanation as to why teachers say they do not include ocean literacy more regularly.

After returning home from Hawai'i, teachers found unique and creative ways to include their adventures in the Pacific into ocean literacy based lesson plans and units in their classrooms. However, several of the teachers already had classrooms grounded in a strong foundation of ocean literate lessons prior to Project ISLE. The following introductory explanation explores teachers' descriptions of their curricula prior to Project ISLE, the activities and lessons in which the teachers participated during the program, and how the different teachers translated the information from the programs into lessons and units suitable for their various classrooms after Hawai'i.

Teachers' Classroom Inclusion of Ocean Literacy prior to Project ISLE

The Project ISLE participants came to Hawai'i with a wide variety of ocean related backgrounds and experiences. Also, several of their established curricula had state mandated standards where ocean education was specifically named, such as with middle grades Earth Science teachers, or were implied as part of a "habitats" standard, such as the third grade teachers' curriculum. However, many other teachers' standards did not include any mention of marine resources or oceanic environments. In the pre-program survey teachers submitted several weeks prior to departure for Hawai'i (See Table 3.3), I asked teachers to answer the following question: "What role does ocean science content education play in your classroom?" Based on teachers' responses, I interpreted their answers and categorized them as into low, medium, and high levels of ocean science content inclusion. Table 4.1 below depicts their usage of ocean science content education in their classrooms:

Table 4.1

Responses to Pre-Program Question: "Please Describe the Role Ocean Science Education Plays in Your Classroom"

Level:	Low	Medium	High
Name:	Alissa, Judy, Amy, Marie, Lee	Sarah, Emily, Ashlyn, Virginia	Lisa, Carly, Philip
Total:	5	4	3

As expected, two of the three Earth Science teachers in Project ISLE had the highest amount of ocean literacy inclusion prior to the program, with the exception of Amy who responded: "Not as much as it should. It is hard to fit all of the state standards into a year; adding to them is a very rare opportunity" (Amy, Pre-program survey). The elementary teachers explained that they used a moderate amount of ocean materials in their classrooms beforehand. Finally, the high school

teachers, who taught Chemistry and Biology in the year prior to the program, stated that they used the least amount of ocean related material. Similarly, the pre-program survey also included a question asking teachers to respond to prompts concerning the frequency with which they include certain key ocean literacy topics in their classrooms. Table 4.2a below depicts the number of teachers who responded for each of the frequency levels, as well as “not applicable.” I compiled this table based on teachers’ individual responses to the surveys submitted online prior to the program. Also, in order to clarify the connection between the statements in the Likert Scale question and ocean literacy, I included the coordinating Ocean Literacy Essential Principles and Fundamental Concepts (OLEP&FC) into the table. However, I did not include these coordinating concepts in the survey questions that the teachers saw so as not to sway their choices.

Table 4.2a

Responses to Pre-Survey Question: “In a typical school year, approximately how many of your classroom lessons include the following topics?”

	Very frequently (4)	Frequently (3)	Sometimes (2)	Hardly ever (1)	N/A (0)
a. Properties of ocean water (Ex: salinity or saltiness) OLEP&FC 1e	1	3	6	1	1
b. The ocean’s geographic features (Ex: Names, connections between oceans) OLEP&FC 1a, 1c	5	1	3	1	2
c. Movement of water in the ocean (Ex: Tides, currents) OLEP&FC 1c	4	3	1	3	1
d. The ocean’s geologic features (Ex: Ocean basins, ridges/trenches)	1	2	4	3	2

OLEP&FC 1b					
e. The ocean's influence on the rock cycle (Ex: How ocean rocks end up on land) OLEP&FC 2a	2	3	3	2	2
f. Erosion (Ex: The movement of sediments) OLEP&FC 2c	4	5	1	0	2
g. The ocean's influence on the weather/climate (Ex: Heat absorption and distribution) OLEP&FC 3a, 3b	4	4	1	0	3
h. The ocean's influence on the water cycle (Ex: Evaporation off the ocean, runoff, etc) OLEP&FC 1f	6	2	2	1	1
i. History of ocean life (Ex: Fossil record of ocean creatures) OLEP&FC 4b	2	2	3	4	1
j. Oxygen production (Ex: Oceanic photosynthetic organisms) OLEP&FC 4a	0	3	3	5	1
k. Ocean ecosystem diversity (Ex: Coasts, estuaries, coral reefs, etc.) OLEP&FC 5e	2	3	2	4	1
l. Ocean life diversity (Ex: Adaptations) OLEP&FC 5a, 5c, 5d	4	3	2	2	1
m. Uses of the ocean (Ex: Food, minerals, energy, etc) OLEP&FC 6a, 6b	3	1	5	2	1
n. Topics associated with people living near the ocean (Ex: Transportation, jobs, natural disasters) OLEP&FC 6c, 6d	4	0	3	4	1
o. Human impact on the ocean (Ex: Trash, pollution, resource depletion, environmental activism, ocean friendly choices, laws) OLEP&FC 6e, 6g	5	1	4	1	1

p. People explore the ocean (Ex: Reasons for ocean exploration, need for ocean understanding) OLEP&FC 7a, 7b, 7c	2	2	2	4	2
q. Collaboration in ocean exploration (Ex: Communication of ocean-related ideas and information, ocean-related careers) OLEP&FC 7f	0	1	4	5	2
r. Technological innovations (Ex: Tools used to explore the ocean) OLEP&FC 7d	1	1	4	4	2

Table 4.2b portrays the same information as above with the individual participants' responses to the survey prompts.

Table 4.2b

Responses to Pre-Survey Question: "In a typical school year, approximately how many of your classroom lessons include the following topics?"

	Very frequently (4)	Frequently (3)	Sometimes (2)	Hardly ever (1)	N/A (0)
a. Properties of ocean water (Ex: salinity or saltiness) OLEP&FC 1e	<u>1 Middle:</u> Lisa	<u>2 Elem.</u> <u>1 Middle:</u> Emily, Sarah, Philip	<u>2 Elem.</u> <u>1 Middle</u> <u>3 High:</u> Virginia, Ashlyn, Amy, Lee, Alissa, Judy	<u>1 Elem.</u> Carly	<u>1 Elem.</u> Marie
b. The ocean's geographic features (Ex: Names, connections between oceans) OLEP&FC 1a, 1c	<u>4 Elem.</u> <u>1 Middle:</u> Emily, Sarah, Virginia, Carly, Lisa	<u>1 Middle:</u> Philip	<u>2 Elem.</u> <u>1 Middle:</u> Marie, Ashlyn, Amy	<u>1 High:</u> Alissa	<u>2 High:</u> Lee, Judy

c. Movement of water in the ocean (Ex: Tides, currents) OLEP&FC 1c	<u>3 Elem.</u> <u>1 Middle:</u> Sarah, Virginia, Carly, Lisa	<u>2 Elem.</u> <u>1 Middle:</u> Emily, Ashlyn, Philip	<u>1 Middle:</u> Amy	<u>1 Elem.</u> <u>2 High:</u> Marie, Lee, Alissa	<u>1 Middle:</u> Judy
d. The ocean's geologic features (Ex: Ocean basins, ridges/trenches) OLEP&FC 1b	<u>1 Middle:</u> Lisa	<u>1 Elem.</u> <u>1 Middle:</u> Philip, Ashlyn	<u>3 Elem.</u> <u>1 Middle:</u> Emily, Sarah, Virginia, Amy	<u>2 Elem.</u> <u>1 High:</u> Marie, Carly, Alissa	<u>2 High:</u> Lee, Judy
e. The ocean's influence on the rock cycle (Ex: How ocean rocks end up on land) OLEP&FC 2a	<u>1 Elem.</u> <u>1 Middle:</u> Ashlyn, Lisa	<u>2 Elem.</u> <u>1 Middle:</u> Sarah, Marie, Philip	<u>2 Elem.</u> <u>1 High:</u> Emily, Virginia, Alissa	<u>1 Elem.</u> <u>1 Middle:</u> Carly, Amy	<u>2 High:</u> Lee, Judy
f. Erosion (Ex: The movement of sediments) OLEP&FC 2c	<u>3 Elem.</u> <u>1 Middle:</u> Sarah, Marie, Carly, Lisa	<u>3 Elem.</u> <u>1 Middle</u> <u>1 High:</u> Emily, Virginia, Ashlyn, Philip, Alissa	<u>1 Middle:</u> Amy		<u>2 High:</u> Lee, Judy
g. The ocean's influence on the weather/climate (Ex: Heat absorption and distribution) OLEP&FC 3a, 3b	<u>3 Elem.</u> <u>1 Middle:</u> Sarah, Virginia, Carly, Lisa	<u>2 Elem.</u> <u>1 Middle</u> <u>1 High:</u> Emily, Ashlyn, Philip, Alissa	<u>1 Middle:</u> Amy		<u>1 Elem.</u> <u>2 High:</u> Marie, Lee, Judy
h. The ocean's influence on the water cycle (Ex: Evaporation off the ocean, runoff, etc) OLEP&FC 1f	<u>4 Elem.</u> <u>1 Middle</u> <u>1 High:</u> Sarah, Emily, Virginia, Carly, Lisa, Alissa	<u>1 Elem.</u> <u>1 Middle:</u> Ashlyn, Philip	<u>1 Middle</u> <u>1 High:</u> Amy, Judy	<u>1 Elem.:</u> Marie	<u>1 High:</u> Lee
i. History of ocean life (Ex: Fossil record of ocean creatures) OLEP&FC 4b	<u>1 Elem.</u> <u>1 Middle:</u> Marie, Lisa	<u>1 Elem.</u> <u>1 High:</u> Emily, Judy	<u>2 Elem.</u> <u>1 Middle:</u> Sarah, Virginia, Philip	<u>2 Elem.</u> <u>1 Middle</u> <u>1 High:</u> Carly, Ashlyn, Amy, Alissa	<u>1 High:</u> Lee

j. Oxygen production (Ex: Oceanic photosynthetic organisms) OLEP&FC 4a		<u>1 Elem.</u> <u>1 Middle</u> <u>1 High:</u> Sarah, Lisa, Judy	<u>2 Elem.</u> <u>1 Middle:</u> Emily, Virginia, Philip	<u>2 Elem.</u> <u>1 Middle</u> <u>2 High</u> Carly, Ashlyn, Amy, Lee, Alissa	<u>1 Elem.</u> Marie
k. Ocean ecosystem diversity (Ex: Coasts, estuaries, coral reefs, etc.) OLEP&FC 5e	<u>2 Elem.</u> Sarah, Carly	<u>1 Elem.</u> <u>2 High:</u> Emily, Philip, Alissa	<u>1 Elem.</u> <u>1 High:</u> Ashlyn, Judy	<u>2 Elem.</u> <u>2</u> <u>Middle:</u> Virginia, Marie, Lisa, Amy	<u>1 High:</u> Lee
l. Ocean life diversity (Ex: Adaptations) OLEP&FC 5a, 5c, 5d	<u>3 Elem.</u> <u>1 High:</u> Sarah, Virginia, Carly, Alissa	<u>2 Elem.</u> <u>1 High:</u> Emily, Marie, Judy	<u>1 Elem.</u> <u>1 Middle:</u> Ashlyn, Philip	<u>2</u> <u>Middle:</u> Amy, Lisa	<u>1 High:</u> Lee
m. Uses of the ocean (Ex: Food, minerals, energy, etc) OLEP&FC 6a, 6b	<u>2 Elem.</u> <u>1 Middle:</u> Sarah, Virginia, Lisa	<u>1 Elem.:</u> Emily	<u>1 Elem.</u> <u>2 Middle</u> <u>2 High:</u> Ashlyn, Philip, Amy, Alissa, Judy	<u>1 Elem.</u> <u>1 High:</u> Carly, Lee	<u>1</u> <u>Elem.:</u> Marie
n. Topics associated with people living near the ocean (Ex: Transportation, jobs, natural disasters) OLEP&FC 6c, 6d	<u>3 Elem.</u> <u>1 Middle:</u> Sarah, Virginia, Carly, Lisa		<u>2 Elem.</u> <u>1 Middle:</u> Emily, Marie, Philip	<u>1 Elem.</u> <u>1 Middle</u> <u>2 High:</u> Ashlyn, Amy, Alissa, Judy	<u>1 High:</u> Lee
o. Human impact on the ocean (Ex: Trash, pollution, resource depletion, environmental activism, ocean friendly choices, laws) OLEP&FC 6e, 6g	<u>4 Elem.</u> <u>1 Middle:</u> Sarah, Emily, Virginia, Carly, Lisa	<u>1 Elem.:</u> Marie	<u>2 Middle:</u> <u>2 High:</u> Philip, Amy, Alissa, Judy	<u>1 Elem.:</u> Ashlyn	<u>1 High:</u> Lee
p. People explore the ocean (Ex: Reasons for ocean exploration, need for ocean understanding)	<u>2 Elem.:</u> Sarah, Virginia	<u>1 Elem.</u> <u>1 Middle:</u> Carly, Lisa	<u>1 Elem.</u> <u>1 Middle:</u> Emily, Philip	<u>1 Elem.</u> <u>1 Middle</u> <u>2 High:</u> Ashlyn,	<u>1 Elem.</u> <u>1 High:</u> Marie, Lee

OLEP&FC 7a, 7b, 7c			Amy, Alissa, Judy		
q. Collaboration in ocean exploration (Ex: Communication of ocean-related ideas and information, ocean-related careers)	<u>1 Elem.:</u>	<u>2 Elem.</u>	<u>2 Elem.</u>	<u>1 Elem.</u>	
	Sarah	<u>2 Middle:</u>	<u>1 Middle</u>	<u>1 High:</u>	
OLEP&FC 7f		Emily, Virginia, Lisa, Philip	Carly, Ashlyn, Amy, Alissa Judy	Marie, Lee	
r. Technological innovations (Ex: Tools used to explore the ocean)	<u>1 Elem.:</u>	<u>1 Elem.</u>	<u>2 Elem.</u>	<u>1 Elem.</u>	<u>1 Elem.</u>
	Sarah	Carly	<u>1 Middle</u>	<u>1 Middle</u>	<u>1 High:</u>
OLEP&FC 7d			<u>1 High</u>	<u>2 High:</u>	Marie, Lee
			Lisa, Ashlyn, Emily, Philip	Virginia, Amy, Alissa, Judy	

Elementary Teachers' Descriptions of their Ocean Literacy Inclusion Prior to Project ISLE.

In addition to the responses on the pre-program survey questions, two elementary teachers spoke confidently about their prior science teaching in interviews and conversations. For example, Ashlyn, the science lab instructor for her elementary school, teaches science as an extension or “challenge” course to second, third, and fifth grade students. Although she teaches a wide variety of subjects and concepts to her students, she explained that her previous instruction also included several ocean-based units. One such unit included a demonstration for thermohaline circulation involving clear plastic tubing, hot/cold water, and food coloring where the water mixes to demonstrate how cold, deep ocean waters mix with warmer surface waters. In her interview, Ashlyn mentioned that she would ask Virginia to take pictures when her students did the experiment again, “Because that is such a cool experiment (*whispers for emphasis*). I did it last year with my kids in fourth grade with the water cycle, and ocean currents ...kids would

still come in and go, “Can we come in?”... They had already seen it, but it’s cool” (Interview with Ashlyn, October 6, 2011, OLEP&FC 1c, 1e, 3b, 3f).

Virginia also spoke confidently about her science instruction prior to Project ISLE. Before she became her school’s curriculum coach administrator, Virginia was an accomplished fourth grade teacher who had earned the “Teacher of the Year” award at both her school and the district level. In her interview, Virginia described problem based units that she and her students conducted concerning the Great Pacific Garbage Patch in which the students learn about the problem and brainstorm potential solutions including ways they could help the issue. She also discussed her “Age of Exploration” unit in detail:

When we talked to our fourth graders about the Age of Exploration and ...you know, the new world and entire continents being news...Our kids get carried away with the excitement of that...And they want to ...they hold on to a hope that we’re still going to unearth a continent that we had not seen before. But to be able to say, you know, there’s space exploration, and there’s underwater exploration...I feel like the ocean has so much that we could continue to look to for ...Because I think they immediately think to land, you know? And I want them to expand ... It just doesn’t seem natural to them to think to the ocean for another level of exploration (Interview with Virginia, October 6, 2011; OLEP&FC 7a, 7b).

Virginia’s comments voice key concerns among members of the Ocean Literacy Network of students’ natural tendency toward land (see “terrestrialism”, Norton, 2003) combined with the final Ocean Literacy Essential Principle, “The ocean is largely unexplored” (National Geographic, et. al., 2003). For Virginia, including these discussions in her classroom was not a conscious ocean literacy inclusion effort, for she admitted that she did not know what the term meant prior to the program. However, based on her description, ocean content inclusion was still a natural and habitual part of her classroom, which points to a potentially higher level of ocean literacy on her part prior to the Project ISLE program. On the other hand, Virginia and Ashlyn’s

confidence was unique among the elementary teachers, and none of the other teachers mentioned extensive ocean inclusion prior to their participation in Hawai'i.

Secondary Teachers' Descriptions of their Ocean Literacy Inclusion Prior to Project ISLE.

Lisa, who is one of the 6th grade Earth Science teachers, selected "very frequently" more often than any other secondary teacher, including the other Earth Science teachers. Specifically, the State Performance Standards for Sixth Grade Earth Science contain the following statements:

S6E3. Students will recognize the significant role of water in earth processes.

- a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice.
- b. Relate various atmospheric conditions to stages of the water cycle.
- c. Describe the composition, location, and subsurface topography of the world's oceans.
- d. Explain the causes of waves, currents, and tides.

S6E4. Students will understand how the distribution of land and oceans affects climate and weather.

- a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.
- b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.
- c. Relate how moisture evaporating from the oceans affects the weather patterns and weather events such as hurricanes." (State Department of Education, 2012).

These standards relate directly back to four of the seven Ocean Literacy Essential Principles, and yet only one of the three Earth Science teachers, Lisa, described ocean education as a "very frequent" part of her classroom instruction by including almost all of the ocean science concepts listed in the pre-program survey Likert scale "very frequently." Philip, another Earth Science teacher, stated in his survey, "I teach Earth Science. Understanding the important role the oceans play is essential to my teaching," and listed most of the Likert scale items as "frequently" taught. However, Amy listed most of the Likert scale items as "sometimes" or "hardly ever" taught in

her classroom, thus providing a full range of responses among sixth grade Earth Science teachers.

As described earlier, three of the secondary teachers' state standards mandated that they include ocean science information in their Earth Science classrooms. However, Lisa was the only one to discuss her ocean science units at length in interviews or casual conversations. What's more, her ocean units seem to go beyond the scientific facts listed in the standards to include ocean environmental concerns: "I've had the kids in the past create these PSA's [Public Service Announcements] about ocean and...even though we don't live at the oceans...just being conscious of our actions and how they affect things you know thousands of miles away" (Interview with Lisa, September 7, 2011; OLEP&FC 1g, 6a, 6e, 6g). In her pre-program survey, Lisa went as far as to say that in a sense, she "never really leaves" the oceans, no matter what she is covering in her classroom. She expanded on this comment later in her interview:

... even if you look at Astronomy, talking about what is it that makes our earth special? Why can it support life? By understanding those oceans... We had really that whole year...always found our way back to oceans... I talk about oceans and what makes Earth so able to support life and the other planets can't. We haven't found life anywhere else so far...yeah, that's where it all starts... We talked about weathering, deposition, and erosion, then we talked about waves, currents and tides in that particular unit. Then we talked about weather and the ocean plays a huge part in that, and we talked about the rock cycle...and we talked about the ocean floor and the movement of the ocean floor and where these plates meet. You have these deep ocean trenches...the deepest part of the oceans and ...we really never left it. And we won't this year. I mean, maybe that's why I love teaching Earth Science. I haven't always taught Earth Science, but maybe that's why I like it because I love the oceans so much. It's just very interesting to me. It's what captivates me as a teacher (Interview with Lisa, September 7, 2011; OLEP&FC 4a, 3e, 2c, 2e, 2a, 1b, 6c).

Similar to Virginia's understanding of the need for ocean education, Lisa also seemed to have a natural tendency toward ocean literacy, even though she did not express a deliberate

understanding of the term or the coordinating Essential Principles prior to her participation in Project ISLE.

Finally, one other secondary teacher seemed to exude a strong sense of ocean literacy prior to her participation in Project ISLE. Although the school year following Project ISLE was Judy's first to teach Oceanography, she explained how her desire to teach the program was one of the reasons why she decided to become a teacher in the first place and even mentioned that to her hiring administrators. She also described how her first occupation out of college was an internship concerning ichthyology and fish identification in South America, and how she has always had a passion to understand the marine world. On the other hand, her two high school counterparts, Lee and Alissa, did not share in her enthusiasm for the ocean.

Based on their descriptions in surveys and interviews and their discussions in program observations, Virginia, Lisa, and Judy had a clearer understanding of "the ocean's influence on [them] and [their] influence on the ocean" prior to their participation in Project ISLE than their fellow participants. What's more, although they may not have been aware of it, their in-depth understanding of ocean literacy was evident in the descriptions of their classroom instruction. However, based on participants' interviews, surveys, field journals, and other data sources, their passion for ocean education was noticeable among their peers in the program.

Elementary Teachers' Discussion of Ocean Literacy Material Inclusion during the Project ISLE. As discussed in the methods chapter, the teachers experienced a wide variety of ocean literacy activities in Project ISLE as well as regular pedagogical lessons designed to help teachers translate what they were learning into their classrooms (e.g., lesson sharing, brainstorming sessions, follow up meeting). During these pedagogical reinforcements as well as in casual conversation throughout, teachers voiced lesson plan ideas and other thoughts about

how they could use the material, activities, and experiences in their classrooms. For example, during the “brainstorming” sessions, the elementary teachers reflected on the cultural experiences of the first day and suggested that students listen to Hawaiian legends and then write their own. They also suggested that students compare Hula traditions to others within mainland US to which the students could relate, such as Karate or Boys/Girls Scouts. Carly suggested that students complete a social studies/science interdisciplinary activity in which they compare and contrast island living to mainland living in terms of accessing resources and the cost of living remotely. In the brainstorming session following the fifth day on the black sand beach with our scientist guide who introduced himself as “Uncle John,” teachers suggested that students write letters to the sea turtles and send them to Uncle John. They also connected Uncle John’s talk to the hula demonstration and how Native Hawaiians believe they are a part of the Earth instead of dominating over it. The elementary teachers suggested that students discuss land ownership and the trash that is accumulating in the oceans in order to examine how students are a part of the Earth.

The lesson sharing times were also fruitful and productive occasions for teachers to increase their pedagogical knowledge. As discussed previously, each teacher came to Hawai‘i ready to share a “tried-and-true” lesson that they thought could potentially be used to implement some of the Project ISLE fundamental concepts. During these episodes, several teachers gained ideas from each other for lessons they could include in the next school year. For example, Judy demonstrated an activity designed to help students understand how sonar works, and, therefore, how scientists know what landforms are on the ocean floor (OLEP&FC 1b). Lisa, Amy, and Ashlyn all ordered a set of sonar boxes for their classrooms. Virginia also ordered a set for the fifth grade teachers to share. Ashlyn also teaches landforms to “pull-out” sections of fifth grade

students. She explained in her interview that thought the activity was excellent and wrote down the information about the resources needed to implement the lesson:

And I think that's why the minute Judy was talking about that, I was writing down everything... But the reason why I wanted it, though, is because I think it's really important for the kids to understand that although we can't see it, that the ocean floor has landforms just like the surface of our land...I'm tactile, and I loved when she showed it. I'm tactile visual learner, and that helped me for some reason visualize [it] (Interview with Ashlyn, October 6, 2011; OLEP&FC 1b).

The Project ISLE teachers found unique ways to take advantage of the lesson plans and activities presented to them during the various speakers' presentations. For example, Marie posted the following on her blog the day of the Marine Sanctuary activity:

Figure 4.1 Marie's Sea Turtle Example Blog

"Arts and Crafts at Teacher Camp"



Figure 4.1 Marie's photograph of her work at the Humpback Whale National Marine Sanctuary. The activity was designed to introduce the teachers to the basics of sea turtle natural history and anatomy using a format that they could incorporate into their classrooms.

"Can't wait to do these activities with my kiddos. So fun!" (Blog Post, Marie, June 15, 2011).

Several of the elementary teachers stated that the activities during the marine sanctuary, one of which is pictured in Figure 4.1, were their favorites, and at least three teachers went on to do very similar activities with their students later that year (see Table 4.3). A few teachers also took it upon themselves to seek out materials and resources on their own during the free time of the program. In her interview, Sarah explained how she developed a new nickname during Project ISLE as a result of her eagerness to bring home authentic Hawaiian resources: "...you know, when we would go and they would laugh at me. All the girls from [my school] would be like, "Yep. Gift shop girl is going over there." ...but it's really [for] the kids at school" (Interview with Sarah, October 7, 2011).

Secondary Teachers' Discussion of Ocean Literacy Inclusion during Project ISLE. The secondary teachers also took advantage of the pedagogical reinforcement activities, or the sessions designed to help them understand how to translate what they were learning back into their classrooms, during Project ISLE. It was during the brainstorming sessions that Lee and Alissa both mentioned ideas for the lessons they would later include in their Forensics and Chemistry classrooms. For example, while reflecting on the lesson in Hula, Lee suggested that since the Hula is designed to tell a story, the chemistry teachers could have their students make leis with the chemical elements, and ask students to act out the elements' properties using their hands/bodies such as in the Hula. The other teachers agreed that such a kinesthetic activity would be great for their vocabulary development. Similarly, in the discussion of the teachers' experiences at the black sand beach with Uncle John, Alissa suggested that teachers bring home sand samples and ask students to compare sands from different beaches under the microscope. She thought the sand comparison could be either between Hawai'i and another beach on the mainland, or even from two beaches on the same island, and suggested a potential forensics

connection lesson. Finally, Philip suggested that teachers use the posters and resources teachers accumulated during the program so students could make dichotomous keys to assist them in understanding classification.

However, before the start of the school year, two of the three high school teachers stated that they did not expect to include much of the Project ISLE information in their classrooms. When asked how they expect the information from Project ISLE to impact their classrooms, if at all, Alissa admitted: “I expect that the information in this course will have a small impact on my curriculum... I'll be teaching chemistry and forensics and will utilize the information as much as I can.” Lee also confided that he thought the program would only have:

Some impact. I have been able to see a few lessons being placed into my plans. The course did lack some depth from a chemistry perspective, so trying to come up with lesson ideas took some effort. The experience is helpful to talk with students about how science is done and jobs that need a science background.

Assertion One: Teachers make Decisions to Include Ocean Literacy Lessons and Units based on their Personal Experiences and Teaching Contexts

Classroom inclusion of ocean literacy is strongly influenced by a number of personal and professional factors including grade level assignment, beliefs about curriculum, beliefs about student abilities, administrative support, and beliefs about high stakes testing/standards. These personal and professional influences were apparent throughout the entire program sequence. For example, different portions of the Project ISLE program appealed to teachers in various ways. They also found unique and meaningful ways to include the new information into their classrooms. The following analysis describes the ways in which teachers included ocean literacy-based Project ISLE materials based on teachers' surveys, interviews, observations, units,

and emails. To begin, Table 4.3 below summarizes the units teachers handed in following the program juxtaposed with the observation conducted in their classrooms. Teachers' units spanned the entire spectrum of topics addressed during Project ISLE including volcanology (OLEP&FC 1b, 1d, 1g, 2g), astronomy (OLEP&FC 1c), marine science (OLEP&FC 1-7), and conservation (OLEP&FC 1h, 6a-g, 7c).

Table 4.3

Teacher Unit and Observation Summary

Participant	UNIT			OBSERVATION		
	Subject, Grade level and lesson duration	Titles/Topics	Ocean Literacy Essential Principles and Fundamental Concepts	Subject, Grade level and lesson duration	Title/Topic	Ocean Literacy Essential Principles and Fundamental Concepts
Philip	n/a	n/a	n/a	n/a	n/a	n/a
Amy	Not submitted	Not submitted	Not submitted	6 th Grade Earth Science 2-3 periods	Modeling the ocean floor (sonar box activity from lesson sharing)	The Earth has one big ocean with many features (1c, 1d)
Alissa	Forensics and Chemistry, 11 th and 12 th grade, 4 class periods (4 hours) total	“The Sands of Crime: A Big Island Murder Mystery” Oceanography “Meteorite Madness!: A Density Lab that’s Out of This World!” Astronomy	The ocean and life in the ocean shape the features of land (2c, 2d)	Forensics (11 th and 12 th grade) 2 class periods (2 hours)	“The Sands of Crime: A Big Island Murder Mystery” Oceanography	The ocean and life in the ocean shape the features of land (2c, 2d)

Judy	Ocean-ography 11 th and 12 th Duration: six class periods (6 hours)	Day 1 & Day 2 – Lecture on seafloor topography Day 3 & 4 – Mapping the Unknown Sea Floor Activity using mystery boxes Day 5 – Research Projects on History of Seafloor Mapping. Day 6 – Take a virtual cruise across the Atlantic	The Earth has one big ocean with many features (1b, 1e) The ocean and life in the ocean shape the features of Earth (2b) The ocean is largely unexplored (7d)	Ocean-ography 11 th and 12 th Duration: 2 class periods (2 hours)	Sea Turtle natural history and classification	The ocean supports a great diversity of life and ecosystems (5a, 5c, 5d, 5f)
Lee	Chemistry 9 th or 10 th grade, 5 class periods (5 hours)	Lesson 1: “Problem Solving on the Hawaiian Reef” Lesson 2: “Meteorite Worksheet” Lesson 3: “Families of the Periodic Table” Marine Biology Chemistry Hawaiian Culture	The ocean supports a great diversity of life and ecosystems (5c, 5d).	9 th and 10 th grade, 2 class periods (2 hours)	Lesson 1: “Problem Solving on the Hawaiian Reef	The ocean supports a great diversity of life and ecosystems. (5c, 5d)
Carly and Marie (Co-teaching)	Earth Science 3 rd and 4 th grade 3 hours	Lesson1: “Volcanoes and Lava” Lesson 2: “Hawaiian Travel Brochure”	The Earth has one big ocean with many features. (1b) The oceans and humans are	Life Science, ocean conservatio n 3 rd and 4 th	Ocean literacy overview with students and Marine Sanctuary paper whale activity	All, with an emphasis on The ocean supports a great diversity of life and ecosystems

			inextricably interconnected. (6c, 6e)	grade One hour		(5c, 5d, 5f)
Lisa	Earth Science 6 th grade, 4 hours	Unit Title: “Exploring the Positions of the Sun, the Moon, and the Earth in Space” Lesson1: “Phases of the Moon” Lesson 2: “Solar and Lunar Eclipses” Lesson 3: “Tilt of the Earth and Climate Astronomy	The Earth has one big ocean with many features. (1c) The ocean is a major influence on weather and climate (1a, 1d, 1f)	Earth Science 6 th grade One hour	Temperature dispersal around the Earth—Land and water heat and cool at different rates (lab demonstration)	The Earth has one big ocean with many features (1e), The ocean is a major influence on weather and climate (3a, 3b)
Emily	1 st Grade 10 science periods Approx. 10 hours	Hawai`i Unit: Volcanoes, Marine Biology, and Conservation	The Earth has one big ocean with many features (1b, 1c, 1h) The ocean supports a great diversity of life and ecosystems. (5c, 5d) The oceans and humans are inextricably interconnected. (6b, 6c, 6e, 6g)	1 st Grade, one hour	Humpback whale conservation issues (lesson plan taken from her second week of her unit)	The ocean supports a great diversity of life and ecosystems. (5c, 5d) The oceans and humans are inextricably interconnected. (6e, 6g)

Sarah	Not submitted	Not submitted	Not submitted	1 st Grade, One hour (unit ongoing)	Marine Biology and Conservation Sea turtle nesting ecology	The ocean supports a great diversity of life and ecosystems. (5c, 5d) The ocean and humans are inextricably interconnected (6e, 6g)
Virginia	Not submitted	Not submitted	Not submitted	Faculty One hour (Not observed in person)	Presentation about what was learned in Hawai'i (Not observed in person)	1h, 5c, 5d, 6c (Not observed in person)
Ashlyn	5 th Grade Four 50 minute class periods	Lesson1: "Mapping the Unknown Sea Floor" Lesson 2: "The Ocean Floor" Lesson 3: "Underwater Volcanoes Volcanoes"	The Earth has one big ocean with many features The ocean and life in the ocean shape the features of Earth The ocean is largely unexplored (touched on with the lesson on sonar)	2 nd and 3 rd Grades, 7 hours (Not observed in person)	Hawaiian Lei making Native Hawaiian orienteering and compass/map skills (Not observed in person)	The ocean and humans are inextricably interconnected (6b, 6c) (Not observed in person)

Elementary Teachers' Project ISLE Ocean Literacy Inclusion

Elementary teachers' inclusion spanned the entire spectrum of activities and information studied and experienced during Project ISLE, and not all lessons were successful. For example, in addition to the sonar boxes described earlier, Ashlyn also conducted a whole unit on ocean navigation and orienteering with her second grade students, which she explained was not going as planned. She wanted to tie in Hawai'i and Polynesian celestial navigation, but the unit was really more about maps, compasses, and directions. She attempted to set up the unit in such a way where students would have to use their new understanding to "find their way" to Hawai'i, but she said that after a while her students begged her to "just get to Hawai'i." Additionally, Ashlyn taught her third grade students how to make leis using false flowers and a hemp-like string material. She said some students spent over an hour just getting a few flowers in a row, and some could not understand the difference between making a bouquet and a lei. They would bundle flowers together in a group and say they were done, but she would correct them and tell them that it was a bouquet, not a lei. Although these lessons may not have gone completely as planned, she was looking forward to another lesson coming up that she knew would be successful. Each year, her students create a highly intricate bulletin board mural using paper cut-outs of figures that tell a story. In the year before Project ISLE, her students created a mural about Paris and Versailles complete with the palace, horses, people, fountains, garden scenes, etc. Every year, parents and administrators rave about how wonderful the mural is, and they leave it up for months before removing it. This year, Ashlyn plans to have an entirely Hawaiian based mural in which students will put everything they learned this year about Hawai'i into the mural scene, and she expects it to be a big success.

On the other hand, lessons elementary teachers included early in the school year turned out successful. For example, Sarah used the paper plate sea turtle activity gained during the Marine Sanctuary visit on her first day of class. She began the lesson by reading a book about sea turtles that she purchased at the Maui Ocean Center and showed the students the sea turtle puppet she purchased as well as many of her photos from the trip. After that, students created their own paper plate sea turtles, but she adapted the lesson to better suit her young children's developmental needs. Instead of using markers and crayons to decorate the turtles' shells, she asked the students to use stencils of various geometric shapes to draw the shapes and practice their fine motor skills in cutting them out. After their sea turtle-filled first day, Sarah explained in the group interview: "Well, the next thing you know, little girls, little boys, everything, 'I have a sea turtle too!' I mean sea turtle beanie babies and everything. So now everybody is really into sea turtles" (Sarah, Group Interview, September 15, 2011). Later in the semester, her students also viewed flip charts about sea turtles on her smart board, explored fiction and nonfiction literature about the reptiles, compared sea turtle species anatomy using Venn Diagrams, created sea turtle mind maps, and students also used their creative writing time to write about sea turtles (Interview with Sarah, October 7, 2011, Observation of Sarah, September 15, 2011). She also explained that she planned on having students adopt a sea turtle later that year as part of her students' "action plan."

Emily also utilized resources collected at the Humpback Whale Marine Sanctuary with her first grade classroom. Unlike Sarah, Emily decided not to include any of her Project ISLE experiences until well into the second semester. She explained that this particular group of students struggled at the beginning of the year with behavior and acting inappropriately. She explained in the group interview that she did not think her students would be able to handle

“special” lessons such as the ones including Project ISLE material, because her students were “still learning how to hold a pencil” and other basic skills necessary for success in school. I observed her classroom on February 1st, 2012 when she implemented a lesson about whales in which she read a book to the students, showed them several video clips, completed a “Know, Want to Know, Learned” (KWL) chart about whales, filled in a whale worksheet, and created “Save the Whale” posters using resources provided to the teachers at the Marine Sanctuary. Although this was the fifth lesson in her 10-day unit she submitted as part of the Project ISLE program, it was the first lesson in the unit that she had presented to the students. She said she was not planning on doing the activities from her unit in the order she submitted them because of the various student and curricular needs that arose in the year.

Marie and Carly also found ways to include the lessons presented at the Marine Sanctuary. Their unit was designed to have students work in groups of three to learn about volcanoes and the Hawaiian Islands. In the middle of their unit, they took a break from their volcano focus to discuss oceans and ocean literacy. They showed the students the ocean literacy website, read through and discussed each of the principles, watched a video clip on whales, and then transitioned into an activity in which students create paper models of whales. In Hawai`i, we made anatomically proportional Humpback Whales, but Marie and Carly decided to ask students to create models of the North American Right Whale.

Secondary Teachers’ Project ISLE Ocean Literacy Inclusion

The secondary teachers also found ways of incorporating their new knowledge of ocean literacy into their classrooms. As she mentioned in the brainstorming session in Hawai`i, Alissa did include a forensics unit using sand samples from Hawai`i. She set up a lab in which students

had to figure out who the perpetrator was in a murder mystery based on the sand samples found on different make-believe individuals. She described the lesson in her interview: “We’re going to be doing the sand and soil unit, so, I’m going to try to include Hawai’i into that unit ... But they’re going to be using that by looking at sand samples under the microscope and using that to determine who the culprit is” (Interview with Alissa, September 15, 2011). Alissa went on to explain how she was going to explain how the different sand samples came to be different colors and textures based on the Hawaiian topography. However, Alissa admitted in her one-on-one as well as the group interview that she does not expect to include any more ocean literacy lessons other than this one lesson her classes, and she did not mention any inclusion in her chemistry classes.

Lee, another chemistry teacher with Alissa and Judy, found unique ways to include ocean literacy into his curriculum. He used fish population statistics to devise a game in which students practice converting units. He described students’ reactions to the lesson in his interview as follows:

They did a really good job. This was actually one of the better years I’ve had in them being able to do conversions so they enjoyed that activity, and I think that activity overall helped lead into a...better lead into how we do conversions. And that was I was able to relate back to it and say, “You know, what do we put here?” So it’s writing down units, which I made them write down all the fish names every time and it’s the whole concept of converting units using the ...them Mitchell analysis process. It just...it seemed to click better...It seemed to work, so I’ll definitely be using it again next year (Interview with Lee, October 12, 2011; OLEP&FC 5d).

However, other than this lesson, his element hula activity, and a few other side anecdotes, Lee also admitted that he doubted he’ll be able to include much more in terms of ocean literacy into his chemistry classroom.

Unique among her high school counterparts, Judy says that she is able to include information from Hawai`i on an “almost daily” basis in her oceanography course. One lesson about which she went into detail was a “bio-ethics” unit she was planning:

Well, even though this is my first year teaching it, I plan on doing a bio-ethics issue... This fall, and just doing a bio-ethics issue about this stuff... for students to research ... maybe give a sort of a jigsaw where there's different groups and they pick a topic and like design their platform and then present it to the class. Then the class gives them feedback about the issues (Interview with Judy, September 15, 2011; OLEP&FC 6e, 6g).

In other words, this would be a problem based inquiry lesson in which she asked students to research an oceanic issue, report on it to the class, brainstorm potential solutions, and critique one another's platforms.

Additionally, although Lisa said in her pre-program survey and interview that she feels as if she “never leaves the ocean” in her curriculum, she contradicted herself somewhat in the group interview when she said that she and Amy have not been able to use much of what they learned in Hawai`i yet since they had not yet reached the oceans unit. In addition to oceanography, the sixth grade Earth Science standards cover tectonic activity, astronomy, and geology, so their curriculum aligned more with the Project ISLE program than any other. However, they still felt unable to include the experiences and pedagogical understandings they garnered on Project ISLE because of administrative pressures for high stakes testing. When I observed these teachers on February 16th, 2012, both were very apologetic for not inviting me out sooner. They explained that their school system had a new superintendent and their low SES school also had a new principal. Both of these individuals were “trying to implement too many new things at once,” which had resulted in extremely long hours and a high stress load for them (Julie observation notes, February 16, 2012). Amy explained that she had not had a planning period in two weeks

because she had daily data analysis meetings. Lisa also showed me several 3-inch, 3-ring binders packed with spreadsheets, data, and information about student achievement and whether they had “mastered the content” for one particular standard or another. Both teachers explained that they wanted to include more of their experiences, and that they had shown their students some pictures and shared stories, but they just did not have the time to plan new creative lessons and were just working from the previous years’ curricula.

Other secondary teachers echoed Amy and Lisa’s sentiments in that they were not able to include ocean literacy as often as many of them would like because of high stakes testing. Some teachers even seemed to view ocean literacy as conflicting with their standards. For example, Alissa and Lee even suggested that it would be irresponsible of them to include more ocean literacy in their classrooms—as if they would be neglecting their duties as Chemistry and Forensics teachers.

Conclusion to Assertion One: Teachers make Decisions to Include Ocean Literacy Lessons and Units based on their Personal Experiences and Teaching Contexts

In most cases, the inclusion of the ocean literacy based Project ISLE materials into teachers’ classrooms was subtle. Apart from possibly Sarah, none one of the teachers performed a complete overhaul of their curriculum or entire units following their experience, and most teachers said that they were just planning on adding aspects of the program, such as stories or pictures, into pre-existing lessons mostly dictated by their standards. On the other hand, the founders of Project ISLE did not set out to foster dramatic changes to teachers’ classrooms—the purpose was to increase teachers’ content knowledge and pedagogical skills to teach it. In fact, several teachers have yet to respond to my telephone and email messages regarding observations,

possibly because they are not planning detailed full-period Hawai`i lessons. Instead, they include examples and stories from Hawai`i into lessons they already had in place (See Assertion concerning inclusion of “real life” below). In general, teachers used this experience in one of two ways: either they planned out a one to three day unit based on what they learned during Project ISLE or they just included tidbits of information here and there on a somewhat random basis—as the topic comes up and a logical tie-in arises, they bring in stories and examples from their trip.

Even in the fall semester when I conducted these interviews, most teachers expected to include material from Hawai`i in the form of pictures, stories, and examples in their classrooms. Teachers explained these intentions in their responses to the follow up question to “What do you think to be the most important concept for students to learn about the ocean, if any?” Table 4.4 further demonstrates this sentiment in teachers responses to the interview question, “How (if at all) do you include this concept (‘the most important aspect about the ocean’) into your classroom?” Teachers’ open-ended responses fell into the following three main categories:

Table 4.4

Responses to the interview question, “How (if at all) do you include the most important aspect about the ocean into your classroom?”

	Examples of how they plan to include ISLE into pre-existing lessons	Modeling OL behaviors in their classroom	Tidbits of information here and there—no specific full lesson or unit
Name	Judy, Lisa, Amy, Marie, Virginia	Sarah, Ashlyn	Lee, Alissa
Total	5	2	2

As with the Project ISLE material, most of the teachers interviewed (5/9) plan to use ocean literacy materials and activities also as added anecdotes to pre-existing lessons.

On the other hand, Sarah says her sea turtle theme is a brand new topic this year and seems to tie into all of her units in some way. Also, Sarah explained how she's re-worked several aspects of her classroom to be more ocean-friendly. Granted, her position as a first grade teacher, which typically has a much lighter emphasis on standards-based testing than other grades, makes it easier for Sarah to do so many different and new things with her students. The teachers who did not feel the extreme pressure of high stakes testing, such as Virginia, the administrative curriculum coach and the two early childhood educators, tend to include more ocean literacy in their instruction, but not always (Emily). In general, teachers are finding ways of including ocean literacy lessons in their classrooms that also fit with their standards. However, for many teachers, this is not very many lessons (Emily, Carly, Alissa and Lee). Also, most teachers do not have the luxury of doing entire ocean literacy units. Instead, they include a lesson here and there that helps to emphasize a bigger standard (Marie, Carly).

Assertion Two: Teachers' Use their "Real Life" Science Experiences to Enhance Ocean Literacy Curricula Inclusion

The teachers in the Project ISLE program view interactions with "real life" science as some of the most valuable experiences they could have as professional educators. According to their application essays, many teachers attended the Project ISLE program specifically to gain increased "real life science" stories that they can share with their students. Seen as more valuable than knowledge gained from a book, these teachers believe the benefits of real life science experiences to include: increased knowledge retention, increased credibility with the

students, increased confidence in teaching, and increased student motivation. In the following section, I analyze how teachers say they are using their real life experiences with ocean literacy in their classrooms and explain their views on the importance of such experiences.

Teachers' Discussion of Real Life Science before Project ISLE

In one way or another, almost every teacher mentioned the benefits of “real life” science in their application essays. For example, Carly explained, “In teaching science, I try to craft my lessons around my own personal experiences. And where my personal experience directly relates to the material being covered, I have observed improved student performance.” Virginia expanded on this idea in her essay where she explained how real life helps learners make sense of their knowledge: “Connecting our studies to real places, artifacts, and events will certainly enrich the learning experience and make the content more applicable to our students.” Alissa also hoped to help students understand her Chemistry curriculum on a deeper level through her shared experiences: “A revamped curriculum in ecology that shows the real-life findings of a students’ teacher I hope will capture the interest and provoke the attention spans of my students.” Amy said that if she cannot bring students out to see the same things she observed, then “the next best thing would be for me to gain firsthand knowledge and experiences to bring back to my students.... Intellectual knowledge is only a small part of education; I believe it is more important to gain wisdom and understanding.” Other teachers were very honest and open about their perceived vulnerabilities. For example, the first sentence of Marie’s application essay read, “As a child and young adult, I always struggled in science.” She went on to explain her hopes for her personal development as a result of Project ISLE: “The opportunity to physically explore scientific concepts that are somewhat foreign to me will be life-changing to my teaching and overall confidence in science.” Finally, one teacher specifically mentioned ocean instruction in

her application essay. Judy explained that she would be starting an oceanography course in the following school year: “Therefore, my hope in gaining admission to project ISLE is that I gain the opportunity for field experience in marine ecosystems that I have longed for. Being in direct contact in that environment will make the intricacies of marine ecosystems much more meaningful, despite it already being my passion.”

Similarly, in their responses on the pre-program survey, teachers’ expressed a variety of expectations for the experience, with half of the teachers specifically looking to gain real life examples to bring back to their students. Table 4.5 depicts the interpreted responses from the open-ended survey question that are characterized as factors.

Table 4.5

Responses to Pre-Survey Question: “What drew you to this professional development experience?”

Factor:	The content of the program ties in well with my standards	I want to increase my content knowledge in these areas	I would like to have real life experiences to bring back to my students	Mixture of the other categories
Name:	Amy, Ashlyn	Alissa, Virginia, Marie	Philip, Lee, Carly, Emily, Judy, Sarah	Lisa
Total	2	3	6	1

In other words, the reasons teachers cited for attending Project ISLE included a desire for real life experiences, wanting to increase student motivation, and direct ties to their state standards. Amy, Lisa, and Ashlyn all said one reason they wanted to come was because the experience touched on many of their curricular topics:

Because I [will] have had the Project Isle experiences, my instruction will be so much more real for me. I will use the specific experiences I have with Project Isle to guide my own students in their understanding of our Earth. When I myself have a deeper and extended understanding of what I teach, my students are better able to understand these ideas and concepts (Pre-program survey, Ashlyn).

Additionally, some responses were more specific than others. For example, Lee wanted to find ways to connect ecology to chemistry, thus making the subject more applicable or “real” to them. As in her application essay, Marie explained her more vulnerable point of view with regard to her learning in the program: “I have always been interested in volcanoes and geology, but science often scared me. This seemed like an amazing opportunity to become more comfortable with science in a supportive learning environment.” In other words, the teachers expected Project ISLE to make the content ‘real’ to them as well as their students.

Examples of the Perceived Importance of Real Life Science during Project ISLE

During the two weeks on Hawai`i, teachers did not always speak quite so specifically about their views of real life science. However, their enthusiasm was evident in their behaviors. For example, every teacher had at least one camera to document their experiences, and many had several that they used in different situations (i.e., underwater, cell phone camera in restaurants, etc.) Also, teachers frequently requested that I take a picture of them examining one particular aspect of an activity or another so that students could see them using transects, studying meteorites, or otherwise interacting with real life scientific artifacts. They explained in the first brainstorming session that they believed when teachers show pictures of themselves doing activities that a school wants to emphasize through their standards or otherwise, then students are able to relate to the activity more and it is memorable for the students.

Similarly, Sarah also went out of her way to take video clips that she could show to her students later, even if it meant risking the security of her electronic equipment by taking it with

her into shallow water. However, she explained in the interview that the risk to her smart phone was well worth it because of the students' reactions:

...I'm listening back to the videos and the things that I saw, and I heard myself and the kids started laughing when I was showing them one of the videos because I was like...and I was talking to [Marie], and she's like, "What are you doing? Are you videoing this?" and I was like, "Yes, I want to show the kids at school." And they all started giggling ... And when they saw the videos of the crabs and the sea turtles and I had one of those that was like the fireworm...Because when we did that reef walk, I mean, we were surrounded by water and I had my iPhone, and they were like, "You do not need to have that here." And I was like, "I *have* to take these videos." So I had it and I was videoing and videoing and videoing, and I mean, I showed the kids today and they were like, "This is so great!" They had so many questions... (Interview with Sarah, October 7, 2011).

Additionally, many teachers constantly scribbled away in their field journals to record learning and to be able to show their students their good scientific habits. Some teachers even filled up multiple journals. One teacher, Emily, confessed in a brainstorming session that she was feeling a little overwhelmed with the amount of information and was worried that she would not be able to remember all the great stories. She explained that she planned to: "just pick and choose stories. Then those lead to teachable moments—they come up with crazy things." She and Lisa both believed personal story telling helps with learning. Lisa explained how she uses storytelling in her classroom because it helps students remember sequences, relationships.

Teachers' Description of the Usage of their Real Life Experiences after Project ISLE

After the program, teachers' continued their explanations of their perceived benefits of real life science. For example, I summarized teachers' interview responses to "What impact, if any, have your experiences in Hawai'i had on your teaching?" in Table 4.6 below.

Table 4.6

Responses to Interview Question: “What impact, if any, have your experiences in Hawai`i had on your teaching?”

	Anecdotal information to reinforce instruction through stories/pictures	One or two lessons only (and no more are planned)	Consistent, regular inclusion using a wide variety of sources (not just pictures and personal stories)
Name:	Lisa Amy Emily Marie Ashlyn	Alissa Lee	Judy Virginia Sarah
Total:	5	2	3

As teachers expected in their application essays and pre-program surveys, most teachers report they are able to use their experiences and “real life” science stories in their classrooms to reinforce pre-existing lessons and make learning more meaningful for students. In general, however, teachers’ discussions of the benefits of “real life” surrounded several strands: they believe real life experiences far exceeds book knowledge; they explained how their experiences helped them understand the material; they shared examples of how they use their experiences in their classrooms; teachers raved about the expert speakers they heard while on Hawai`i; and teachers shared how their real life experiences were specifically beneficial in terms of ocean literacy.

First, although teachers agree knowledge gained from a book or traditional class is valuable, learning the material first-hand out in the field is a far superior way to learn any subject, including ocean literacy. For example, Lisa explained how her experiences increase students’ motivation to learn: “I got so much out of it as far as experiencing vs. reading about it.

And Hawai'i is a very intriguing place anyway. People hear about it and they're interested...

And I think even on that level, my own classroom students are exposed more because I was there versus us reading about it together in the textbook" (Interview with Lisa, September 7, 2011).

Judy said that she feels an increased sense of credibility when teaching because of her participation: "I think what makes a lot of my lessons, especially the ones in Life Science and now the ones in oceanography, so meaningful is that I have firsthand experience about it. So I can actually talk about it and say 'this is how it is. This is what it looks like.' As opposed to just reading a book and talking about it" (Interview with Judy, September 15, 2011). Virginia's description combined that of Judy's and Amy's: "...it felt so good to be able to have more to back it up, rather than...had I just read this in a book, my knowledge would be much more limited. And so the fact that I can expand with personal connections makes it all the more exciting for them" (Interview with Virginia, October 6, 2011). Finally, Sarah took her explanation one step further and described how she thinks first hand experiences are even more valuable than college or graduate level learning:

I mean, because...if I had taken a course on all these things, it wouldn't be in my heart and in my mind like it was being there...I mean, you can take a course somewhere and learn and learn, but it doesn't give you—to me—the passion of really bringing it back, bringing it to life, like actually being there...And I think the children hearing me standing on the reef and doing the reef walk and me saying, "I'm going to share this with my kids at school." And they heard me say it. I mean, how cool is that? I mean, the kids...if I had taken a class and gone, "So I'm going to teach you about..." And that's important and that's good, but this was just over the top. I mean, it really was. It's amazing (Interview with Sarah, October 7, 2011).

In other words, the Project ISLE teachers believe their first hand experiences are irreplaceable, and no form of media could bring about the same results.

In their interviews and post-program surveys, teachers went into more detail about how they believe the "real life" experiences help them and their students understand the material. For

example, Lisa explained that she uses storytelling in her classroom to help students remember sequences and relationships:

I mean we talk about how the currents influence climate and so you talk about one side of the island of Hawaii receiving more rainfall because of the way the currents move in and it rains itself out and you have the dry side of the island. And what was amazing to me was to look at that mountain and see that dividing line. And seeing one side of that mountain lush and green and the other side dryer and more barren (Interview with Lisa, September 7, 2011).

Lee believes first hand experiences bring science to life for students: “I just think it makes it more alive for the kids and ... more interesting and keeps their attention and helps them remember it. I feel like we remember things when it’s related to something and it’s more like a story” (Interview with Lee, October 12, 2011). Judy explained how she believes her pictures help students remember information: “...just having the first hand experience that you can talk about ... you know the kids like seeing me being goofy in front of it. And it was just like, ‘Wow, OK.’ That might make the kids remember a little bit more than me just showing a picture of it from some textbook” (Interview with Judy, September 15, 2011). Finally, Marie described how having firsthand experience made her more confident to teach science and that she now feels that she needs additional experiences like Project ISLE:

...when you can speak out of experience to kids or to anybody...you just have more of a deeper understanding. I mean, I don’t fear telling them about Hawaii or any of the stuff that we learned because I know it. They can ask me a question about A`a and I’m like, “Ok, well let me tell you.” I mean, it’s not like I read it in a book. That personal experience makes you so much more confident...Yeah, but I need now like a physical science trip, I need like chemistry, I need all these experiences. And I need first grade physical science (Interview with Marie, September 15, 2011).

Teachers used their real life examples in various ways in the classroom. For example, Judy explained how she almost mentions her experiences in Hawai`i on a daily basis in her oceanography class: “And my kids, you know, they’re curious about it...So I was able to show

them pictures of us, you know, of the different craters and stuff like that...I showed them a lot of pictures from our trip thus far, and I probably will when we get to the fish unit as well”

(Interview with Judy, September 15, 2011). Carly and the other elementary teachers shared their photos with the rest of the faculty at their school. Carly explains that their presentations put a few misconceptions about their trip to rest: “we showed them all the pictures ...and they thought we were drinking Mai Tais on the beach, so we kind of showed them that we were in the snow as well as I mean every kind of other...And a lot of people came up and said that was great. I’m glad we got to see all the things you guys got to do” (Carly, Group Interview, September 15, 2011). As described earlier, Emily used photos of herself interacting with the real life science to excite students: “I took a lot of pictures where I was in the picture pointing to something or doing something, so I’m excited to have them visually see it and then teach the lesson after I’ve shown them a couple of pictures on that particular day, but just a whole Hawaii unit” (Interview with Emily, October 7, 2011). Virginia described how her model lessons to the fifth grade students has helped to spark discussions about Hawai`i all over their school building:

I showed them a picture, and I wish I had taken a panoramic because the picture was dark and dreary...and it was also neat to show them the follow up about...I think it was August 6th –Pu`u`o`o—again. And so I said, “You know, this is just showing that when you’re planning your trips to places like this, it could change every day, and you have to be so aware.” And then it excites them to think about, and they’re like, “Oh my gosh, well you had just left!” So it’s creating quite a dialogue across the building because the kids will stop you and say, “Well who else went with you on the trip?” And they’re asking questions that they really already heard. Because I’ll say, “Well you remember what I told you from the power point.” And they’ll say, “I know.” But they just want to engage in more conversation about it, and they’re excited...the energy that is felt this year due to the fact that we returned and the pictures are so, so powerful... (Interview with Virginia, October 6, 2011).

In other words, teachers use their pictures and the coordinating stories to excite, engage, and motivate students.

Additionally, teachers almost unanimously expressed gratitude and appreciation for the wide variety of top scientific experts that we met while on Project ISLE. They explained that not only did they learn and understand more of the content because of these knowledgeable individuals, but they also felt like they had significant “real life” stories that they could bring back to their students about meeting these scientists who do such meaningful work in their fields. Again, such experiences make them feel more legitimate as science educators and professionals. For example, Sarah went to great length to make sure she had a picture with every speaker or activity leader in the program because she felt: “I mean, those people that were there that taught us...I mean, that was amazing” (Interview with Sarah, October 7, 2011). Judy agreed saying, “And I think all of our speakers were phenomenal...I loved every single one of them...so that was perfect” (Interview with Judy, September 15, 2011). Ashlyn explained that she was even impressed with the impromptu speakers that we did not even have on the itinerary: “Good grief. Everyone we had was fantastic. Even that ranger that wasn’t even signed up. Yeah, the knowledge that everyone had to give us...” (Interview with Ashlyn, October 6, 2011). Virginia went so far as to say that she was so impressed with the real life experts that she thinks being a scientist was a prerequisite for living in Hawai‘i: “I mean, we had such wonderful speakers, and everyone was so knowledgeable, and I’ve told several people that I’m convinced that Hawai‘i is just filled with scientists because we just met so many passionate, intelligent, and really motivated people” (Interview with Virginia, October 6, 2011). In other words, the teachers felt that these professionals heightened the quality of their real life experiences and therefore the quality of their learning and the information they could pass on to their students.

However, most important to this research is teachers’ usage of their real life knowledge and experiences in their classrooms with regard to ocean literacy. Similar to the descriptions

above, teachers believed their firsthand work in oceanography and marine science education strengthened their understanding and pedagogical skills in ocean literacy. Lisa felt that she could “now discuss ‘Ocean Literacy’ with my students with more authority because I have a deeper and extended understanding” (Interview with Lisa, September 7, 2011). Judy provided one example to explain how her real life experiences helped to expand her already considerably strong science content knowledge:

It like reinforced what I felt already. I think I talked about how Uncle John was just like, “Yeah this storm surge brought in that traffic sign from LA, and you know it’s just like trash from somewhere that’s like 2000 miles away, you know? It’s just kind of like that North Pacific Gyre is just garbage. So hearing stories like that as opposed to just reading about them on BBC or what have you, you know...It just supports what you already think about ocean literacy (Interview with Judy, September 15, 2011).

Lee explained how his fish activity helped teachers make connections between chemistry and other disciplines: “the students don’t see how anybody really uses [chemistry] out there other than we got a bunch of chemicals mixed together so bringing in all these different aspects from astronomy to oceanography ... and the aquarium...chemistry is used in all these different places and that has been a really good experience from Project ISLE” (Interview with Lee, October 12, 2011). Sarah compared her experience to visiting an aquarium: “just going to the aquarium...sure that would be one way to experience it. But to actually, you know, feel the sand in your hand and to see the animals in front of you is ...is to me, that was just the most amazing thing” (Interview with Sarah, October 6, 2011). Virginia provided several specific examples of how she was able to answer students’ questions using her real life oceanographic experiences:

And they want to know a lot...the sea turtles are just captivating to so, so many...one of them said, “I think that the sea turtle looks sick.” And I said, “No, I think he’s just sunning himself.” But they just want to make sure...they just want to take it all in...Yeah, just wanting to know more about the difference between snorkeling and scuba diving...Um, they loved...I showed them my identification card with the little pencil attached—That was the neatest thing, I thought. Because we were able to feel as though

we were studying under water, so I showed them that, and they were like, “That’s the actual one that went underwater with you?!” And I was like, “Yeah, and you can see here what I was able to see. My little check marks are still there.” (Interview with Virginia, October 6, 2011).

Virginia explained later in her interview how that little identification card helped her understand both the content and how to teach fish identification to her students: “I really am glad I had the opportunity to hold that identification card while I was in the water. That meant a lot to me and you can relate that to the student by giving them as many visuals to the students as possible, so I feel like it helped with...my methodology (Interview with Virginia, October 6, 2011). Like Virginia, Lee understands that teaching ocean literacy can be challenging, pedagogically. He believes that students will not have a full appreciation of the ocean unless they too have firsthand experiences with it: “I think a big thing that needs to happen is experience the ocean. Once you see the beauty of what in the ocean, you are connected to that environment. Then you are invested and want to protect that environment more than you would if you just read about it in a book” (Interview with Lee, October 12, 2011). In a sense, Lee’s views summarize how the firsthand experiences helped teachers appreciate ocean literacy on a much deeper level. As Lisa explains,

While I feel that I had a great respect for our oceans, now I have a much deeper understanding of the interrelatedness of humans and the oceans. I think that the Project ISLE experience made it all so much more real to me. Before Project ISLE I may have had a good overview of ocean literacy - but it was an "armchair" understanding. I feel the Project ISLE helped me to live and experience these understandings first-hand. I can now discuss "Ocean Literacy" with my students with more authority because I have a deeper and extended understanding... I have a desire to continue my education and development of "Ocean Literacy". I want to take action both personally and professionally to become involved in this worthy cause (Interview with Lisa, September 7, 2011).

Conclusion to Assertion Two: Teachers' Use their "Real Life" Science Experiences to Enhance Ocean Literacy Curricula Inclusion

Almost all teachers use "real life" ocean science in their classrooms to show students that they have "been there" when discussing ocean literacy and feel a sense of increased credibility to help students understand content on a deeper level. All teachers in one way or another expressed an appreciation for their firsthand experiences with scientific knowledge. They believe since they have "been there" then students will be more interested in the content and retain more information. In other words, by having "real" stories to tell, their lessons become more meaningful, and students will learn more than if they just read about it in the books. Therefore, Alissa collected "real" sand samples, Lee told stories of his experiences snorkeling, Virginia made her bulletin board and gave presentations, and all of the teachers used their ocean related pictures in their lessons. On the other hand, a possible negative case for this Assertion might be Emily's contradictory comments in her interview. Although she was one of the teachers to take the most pictures (as described above), by our interview in October, she had not included any of her experiences in her classroom or shown her students any of her pictures. When asked how she has used her experiences in her classroom in the interview, she struggled to provide an answer and gave one from another trip she took to Yosemite instead. She explained that she did not think her students were "ready" for her Hawai'i lesson due to their poor behavior in her class so far: "...I'm thinking after Christmas they'll be ready for it. I mean I'll include what I can, but it's been kind of a rough start" (Interview with Emily, October 7, 2011). In other words, she seems to think that incorporating her Hawai'i experiences in the classroom is an extra experience that she can only do if the students behave well or if there is enough time. However, Emily's description was unique, and most teachers would agree with Sarah who loves to share stories

from her experiences: “it’s one of those experiences that I’m *never* going to forget. And it’s just...every little bit is so vivid in my mind. It really is. And so I loved to talk about it and share about it. When people ask me, “Oh how was your Hawaii trip?” And I was like, “Do you have an hour??” (*Laughs*)

Assertion Three: Teachers’ Include Project ISLE Ocean Literacy Material Beyond their Individual Classrooms if Sufficient Administrative Support is Available

An unexpected theme among the teachers was their desire and tendency to share their Project ISLE experiences beyond their individual classrooms. Teachers found ways to include what they learned in Hawai‘i to benefit other students, their schools, or their communities. According to the data, teachers felt that they learned very valuable information and most were comfortable enough in their knowledge to share it with others beyond their classrooms, if their administration supported such a movement. This extracurricular sharing began before and during teachers’ experiences in Hawai‘i. For example, a local newspaper interviewed Philip about his excursion and it was published during the program. Also, as I described earlier, four teachers kept blogs throughout their travel experiences to share pictures, explain the science they were learning, or describe funny or interesting experiences. Three of the teachers’ blogs were specifically designed for their students, and they announced their blogs on the last few days of the school year so that their students could “follow” them. Alissa explained how her previous students come up to her to comment on her work: “But my old kids from last year were following my blog, so they’ve come up to me at the beginning of the year and they’re like, ‘I saw your blog! Those fish were awesome!’” (Interview with Alissa, September 15, 2011). Similarly, several of the elementary teachers sent post cards home to their students from the previous year

during free time on Hawai`i. However, as would be expected, the majority of the inclusion beyond the classroom occurred after the program's conclusion.

Teachers' Inclusion of Project ISLE Ocean Literacy Materials, Activities, and Experiences after the Program

Following their experiences in Project ISLE, teachers shared their experiences with their faculty, other students, the whole school, and the greater community. For example, Philip explained in the group interview that upon returning to the mainland, an additional newspaper wrote a story about him and his adventures in Hawai`i. After that, his administrators asked him to present a summary of the information he learned to his fellow teachers on two different occasions:

... we had a day where I had to go around and talk to the teachers. In fact, we had it again this past Monday. I got the day off, but I had to be in the school and we had to talk to the teachers in planning about what we did and how to include it and lots of different stuff and they've got links to a lot of your blogs and stuff, so it was really, really positive reaction. Especially from the Life Science teachers. The Life Science teachers were really excited about all the stuff I had. They took all my posters. I showed them all the stuff that we got. (Response in Group Interview, Philip, September 15, 2011).

On the first day of "pre-planning" before the students arrived, the elementary teachers presented their new knowledge to their colleagues by showing pictures, relaying stories, demonstrating the hula, helping their colleagues create leis, and tasting traditional Hawaiian foods.

Figure 4.2:

Elementary Project ISLE Bulletin Board



Figure 4.2 Virginia’s Bulletin Board Depicting their Experiences in Hawai`i

Prior to the first day of pre-planning Virginia created the bulletin board in front of the media center displayed in Figure 4.2 to show the whole school community what they learned. Sections of the board include ocean literacy, volcanology, astronomy, conservation, and the Hawaiian culture.

Since all six elementary school teacher participants teach at the same school, the amount of inclusion beyond their individual classrooms in that location was outstanding. In our interview discussion, Virginia summarized the various grade levels that were impacted by Project ISLE: “First [grade], and then no second grade, but Ashlyn is going to see second

graders in challenge...And then our third grade is Marie, fourth is Carly, and then I was able to hit the fifth grade. And ... I'm hoping to continue that throughout the year” (October 6, 2011). As described in Assertion One, Marie and Carly worked together on a Hawai`i themed unit. Their culminating activity for the unit was a celebratory luau to which the administration and all their students’ parents were invited. Virginia explained how one of the parents even carved a pig out of a watermelon in honor of the occasion (see Figure 4.3 below).

Figure 4.3:

Watermelon Pig for 3rd and 4th Grade Celebratory Luau, Carly and Marie



Figure 4.3: Picture from Carly of a portion of the celebratory luau that served as a culminating activity for Carly and Marie’s co-taught science unit concerning Hawai`i, volcanoes, ocean literacy, and conservation. A parent of one of the students carved this “pig” out of a watermelon and used it as a storage container for pulled pork (Email from Carly, March 1, 2012).

Virginia also worked with small groups of students for enrichment or remediation, and she says she's found ways to tie in Hawai'i and ocean literacy "with almost everyone she's seeing."

What's more, Virginia was the only administrator among the participants, and as the school's curriculum coach, she has been able to spread enthusiasm and awareness about Hawai'i and ocean literacy in a powerful way. In her interview, she explained how this year was special in her view:

So I think this is a really special year that we were able to just make a school wide splash about it...pardon the pun. (*Laughs*) But that's what's happening and I think that we're all feeding off of a really positive energy, but what we've been able to do is let the other teachers know what an amazing resource Hawaii is for our country and for education and for science (Interview with Virginia, October 6, 2011).

This school wide "splash" has extended to teachers who did not participate in the program. For example, because of Virginia's presentations, several of the fifth grade classrooms conducted entire units on Hawai'i, including writing their own myths and creating "travel brochures" for the various islands depicting their topography, key sites, etc. Additionally, the music teacher decided to tailor his lesson on rhythm to the fifth grade unit. He used Hawaiian rhythms and volcano terminology to help the fifth grade students write a song about Hawai'i, which they performed over the intercom system during the morning announcements one day. Toward the end of her interview, Virginia summarized why she felt the need to share so much of her learning with her school community:

Because it's important I think, this year to keep the momentum going...and to help the teachers get as much from it as I can. It's been really, really great as I've been going into the classrooms to see the teachers engaged. Because...you know, I certainly didn't require that they don't sit at their desk and say, "Please don't grade papers while I'm in there." But they truly were interested because the things that we were able to share with them at that initial faculty meeting—we just gave a very brief overview...We just wanted to say, look at all of these areas that we were immersed in...So it was neat to see the

teachers put down their pens and really listen and ask questions too. And so I feel like it's really important for us to maximize that this year too, since, you know, it's so fresh. And then they'll be able to do their own research and ...and tie in as they can later (Interview with Virginia, October 6, 2011).

Planned Inclusion beyond the Classroom

Although the work the elementary teachers shared beyond their classrooms was exceptional, several of the secondary teachers also had plans to include their school in their learning. For example, Lisa had plans to use the Public Service Announcements concerning ocean environmental issues in a school wide fashion: "These PSAs can be published in the paper. Videos can be watched on the school distribution or posted of School Tube. Perhaps a CD of all the PSAs could be compiled and distributed" (Lisa, Post-program survey). Also, although Lisa admitted at the group interview that she and Amy had not included much of their learning from Hawai'i into their lessons, she described their plan to create a mural about Hawai'i using interdisciplinary work:

...we were talking about involving the art teacher and having her create an oceans mural and telling her what we wanted integrated in the mural and getting our kids involved in the creation of it. And we wanted to be able to do a cross-curricular type thing. Like getting kids writing haikus or stories and just posting their work at different places along the mural and as we learn these things in science you know the kids could talk about diagramming a wave or talking about ocean currents or ... Even conservation how do we depend on the oceans. You know we wanted to be able to...even the math. You know, to be able to get the numbers in there. How big are the oceans? What's the biggest ocean? Ranking them, comparing them in terms of square miles. ...I think what we envisioned with the mural is getting all the teachers involved. It would be some language arts, mathematics, and the kids in all the different classes would be engaged in it and have a part in it as opposed to just our science classes (Response in Group Interview, Lisa, September 15, 2011).

However, their ambitious and exciting plans were unable to come to fruition due to a lack of administrative support. As Lisa told me at her observation, they requested time from their

administration to plan for and implement the project, but the planning time was not awarded. Additionally, due to the extreme pressure of student performance these two teachers faced at their school that year (see description above in Assertion One), it is doubtful that Lisa will be able to implement her Public Service Announcement this year as she had in previous years, let alone the additions she discussed.

Other teachers had exciting plans for community involvement and inclusion of Project ISLE ocean literacy material beyond their classroom. For example, Sarah described how she wanted her students to contribute funds to adopt a sea turtle later in the year. However, Ashlyn's plan would be the most impactful of all: she explained that she enjoyed her experiences in Hawai'i and feels like she learned so much that she would like to mimic the trip and take a group of students to the barrier islands off the coast at some point that year or next. She explained how Project ISLE "filled me with so much desire. I can't tell you enough. I don't know... See yeah I'd love to do the barrier islands with the kids because its close and we've got families that would do it" (Interview with Ashlyn, October 6, 2011). However, when I asked Ashlyn in an email about her plans for a trip and her previously stated plans to construct a mural on the bulletin board outside her room about Hawai'i, she replied:

We have OD'ed on Hawaii. The kids got it from Marie before I started teaching it and nobody wants to do it anymore. I had done a lot of science with it and the sonar type boxes but after that even I am not interested. We have moved on to statistics and probability and the breeding of thoroughbreds to do a [bulletin] board if I have time on the Kentucky derby. I am sorry... (Email from Ashlyn, February 1, 2012).

In other words, although the elementary teachers were initially "fired up" to share their experiences with their colleagues and many did, they reached a point of saturation in which both the students and teachers felt as if continuing to discuss Hawai'i would be impertinent.

Therefore, other than the lessons described in Assertion One, Ashlyn only included lesson plans and units coordinating with ocean literacy that she had previously included.

Conclusion to Assertion Three: Teachers' Include Project ISLE Ocean Literacy Material Beyond their Individual Classrooms if Sufficient Administrative Support is Available

The Project ISLE participants valued their learning so much, that most of them were eager to share their experiences from Hawai'i with almost anyone in their school community. The fact that they felt so compelled to share their experiences with their peers, administration, and school community is a demonstration of the high regard with which they hold the program. The Project ISLE teachers have led faculty workshops, shared their experiences on blogs for former students, uploaded pictures to teacher data bases, and even plan to take a group of students on a similar trip to the coast. Also, I should note that some of the teachers may have felt compelled to share because their schools and PTAs helped them fund the cost of their airfare, so they may have wanted to display evidence that the money was well spent. A possible negative case for this assertion would be Lisa and Amy. As described previously, they were unable to complete the mural they had hoped to erect due to a lack of administrative support. Also, apart from their blogs, the high school teachers did very little by way of inclusion beyond the classroom. Judy explained why she posted so many pictures to a data base for her colleagues to access: "Our administrators have been, 'Come on you guys. We want to hear about Hawaii' so I put I guess 50 on the shared drive" (Judy, Group interview, September 15, 2011). However, this was the extent to their inclusion beyond the classroom.

Assertion Four: Programs like Project ISLE can have Unintended Impacts on Participants’ Classroom Inclusion, such as Increased Enthusiasm for Science Teaching

The final assertion that emerged among teachers with regard to their classroom inclusion was the teachers’ sense of renewal, revival or a reenergized feeling in their love for teaching and science education following their experiences in Project ISLE. In general, teachers explained that the end of the year prior to Project ISLE was stressful and overwhelming. Several teachers explained that they even experienced symptoms of teacher “burn-out” at the end of the year. However, after having the firsthand experiences with the natural world and especially with the ocean, many teachers felt refreshed and excited for the new school year. In the section that follows, I detail teachers’ self-described sentiments of renewal as a result of the Project ISLE experience.

Even before departing for Hawai‘i, several teachers explained how they expected to feel rejuvenated as a result of their participation. In her application essay, Amy explained, “This direct engagement in the field will give me a new freshness and energy that will spill over to my classroom.” Alissa also explained how her experiences in Hawaii would refresh her teaching: “I strongly feel that the success of my students is directly related to the attitude that I reflect upon my students in the classroom. An excited teacher evokes a passion for learning for his/her students!” (Alissa, Application essay). Alissa reiterated this sentiment in the orientation meeting. At the introduction of the session, the leaders asked everyone to introduce themselves and share one thing that they are most excited about with regard to their upcoming trip to Hawai‘i. Alissa’s response to this question was that she was “Excited to be excited again” about teaching and science education. In her pre-program survey, Lisa explained that by participating in experiences like Project ISLE, “I keep my own enthusiasm alive. Children can certainly sense

when a teacher herself is electrified by what she teaches and respond accordingly” (Lisa, Pre-program survey). Similarly, Virginia expected her enthusiasm to catch on with her students: “Enthusiasm is contagious, and if I have first-hand connections to our studies, I will bring an excitement and authenticity to the lesson that would not otherwise be possible” (Virginia, Pre-program survey). In other words, since the teachers seemed to expect an increase in their enthusiasm or morale, it seems likely that they had experienced such an increase in previous workshops.

After the conclusion of the program, several teachers went into great detail describing how Project ISLE helped them gain an increased morale for teaching. For example, Amy explained:

I feel very fortunate to have been a part of this hands-on learning experience. Not only did I gain new knowledge that I can share first hand experiences of but I was also "reenergized" by actually seeing and doing. Experiencing this with other teachers and with Lindsay, Seth and Steve was so valuable in itself. We shared ideas and just being able to talk to others who are compassionate for learning and the environment was refreshing... For me, Project Isle renewed my excitement for teaching (Amy, Post-program survey).

Amy repeated these sentiments in her interview when she explained how Project ISLE: “gave me a boost of energy, or refreshment ...It made me on fire again for education. And you need that I think because you just get so overwhelmed with the paperwork and the stress...it made me hungry again. It made me remember why I’m doing this, you know?” (Interview with Amy, September 8, 2011). Lisa expanded on these views and explained how she believes all teachers need to experience programs like Project ISLE:

It was invigorating... I think the reason we’re in teaching is because we love conveying knowledge of others...It’s helping others develop their love of their Earth. And I think that if you don’t have that renewed, you’re ineffective as a teacher. If you aren’t renewing yourself and pushing yourself to seek new knowledge and experience the world...whether you teach Language Arts or Earth Science...you’re just going to stagnate. And I think we’ve all reached that point. And if we haven’t reached it, we will at some point in our careers. And we have to seek out these experiences that help us to grow and renew ourselves (Interview with Lisa, September 8, 2011).

Sarah went so far as to finance the purchase of original artwork that would help her relive some of the experiences in Hawai`i at a later date. She also used her pictures to help her and Emily revive that feeling of rejuvenation mid-year when they were feeling stressed. She explained that on an especially tough day full of conferences, demanding parents, and student problems, she texted Emily a picture of the two of them:

...at a beautiful spot in Hawaii, and I said, 'Just a little happy for you.' And it literally ...it brings back...because stress is bad for everybody, and when you think of a happy place...you know, and I literally...when I was in Hawaii—I can smell the smells, I can feel the black sand. All those things and it just puts me in a happy place. And so I texted her a picture and I was like, "Feels like yesterday that we were there." But when we were learning about it and actually being there, I mean it was amazing. I loved it. It was really great. I want to go back. That's why I like doing my little studies, you know? I'm like, this was really fun (Interview with Sarah, October 7, 2011).

Later, Sarah was brought to tears when recalling an especially powerful memory from snorkeling:

I mean, at that place it was rough waters, and it was windy, and it was dark, and you just didn't know what you were going to see, and when you put your face in, it was like "Ah!" And that feel of the breathing and all you can hear is yourself breathing and then seeing the fish... I mean, there's not a better experience. I'm like, you just...in my life, because of all that I've been through (*Starts to tear up*) I'm like, "This is so awesome!" (*Voice falters*) I'm sorry I'm crying... It was... It was what I needed (Interview with Sarah, October 7, 2011).

Finally, Ashlyn believed that her feeling of renewal went beyond just a temporary boost in morale. She believed that she had been forever changed by the experience, and she was especially grateful because she almost did not attend the trip. When asked to reflect on her former expectations of the program, Ashlyn explained:

... there was a point where I was going to back out...I had a sense that something really bad was going to happen... And it ended up being OK in the end. But I was ready. I was backing out. And Virginia said no, don't do it...I didn't know what to expect...I was highly encouraged by many teachers here to do it. So I was just kind of doing it because I was the science lab teacher. So...what did I expect? I don't know. Like, I didn't read

anything about the movie before I went...Oh my gosh! Best movie ever!! (*Laughs*)...I'm glad I didn't know. Because it filled me with so much desire. I can't tell you enough... It's just opened up....It's changed me and I can't put a finger on it...it's something as silly as a two and a half week trip...it's changed me. It doesn't make me care or worry about some things, and...I don't know. I don't know how to put it (Interview with Ashlyn, October 6, 2011).

Conclusion to Assertion Four: Programs like Project ISLE can have Unintended Impacts on Participants' Classroom Inclusion, such as Increased Enthusiasm for Science Teaching

Teachers have a lot on their plates, and many teachers feel like more and more is expected of them every year. The stresses of high stakes testing, parental pressures, lagging student achievement, etc. can all cause sentiments of teacher “burn out.” Programs such as Project ISLE give teachers a chance to remember why they became teachers to begin with: They are surrounded by passionate educators excited about what they are learning and located in a beautiful location. This results in a sense of rejuvenation or renewal for their profession or for teaching science at the end of the program. I do not think it would have been nearly as potent if the program had taken place in a classroom in a city. Based on the data I've collected and from personal experiences, teachers need to be really removed from their familiar settings near their homes and spending time outside. Several of the teachers actually sought out the experience for this reason specifically—they felt like they “needed” it for personal reasons (Sarah and Carly) and were “excited to be excited again” about teaching (Alissa). Additionally, of the teachers that expressed this feeling, Sarah has included more ocean literacy topics into their classrooms--As if she wanted to bring that peaceful feeling they felt in Hawai'i and the tranquility that comes with the ocean into her classroom. On the other hand, a negative case for this assertion may have been Lee who said he thought the program impacted him about the same as any other program:

“I would say...like any experience it has an impact if you use it properly and you...you know, while you’re there you took full advantage of it” (Interview with Lee, October 12, 2011).

Summary of the Chapter

Teachers are finding ways to include ocean literacy material from Project ISLE in unique and innovative ways. They created full lessons and units, included real-life stories throughout regular curricula, share their knowledge outside of their classroom, and exude an increased morale as a result of their experiences with the ocean. As described in Assertion Two above and based on multiple data sources (observations, interviews, surveys, emails, etc.), much of the ocean literacy instruction that takes place is incidental and unplanned. As teachers go through a lesson, they will suddenly think of a connection that did not occur to them previously and will take a moment to discuss this with their students. On the one hand, such side notes could make ocean literacy instruction a natural and consistent presence throughout the year, but it does not include in-depth analyses, evaluation or assessment that typically make learning last.

In summary, the impact on classroom instruction of ocean literacy following an experiential, marine science, professional development program can be explained in four ways:

1. Teachers include ocean literacy material in unique full lessons and units that are appropriate to their grade levels. Also, elementary and middle school teachers tend to include more than the high school teachers.
2. Teachers view the real life ocean-science/Earth science experiences acquired during the program as the most valuable part of the experiential program. Teachers believe having photographs, stories, and videos of “real” ocean science situations helps

- teachers gain students' attention, increase student motivation, provide a sense of credibility, and increase teachers' confidence in teaching that subject.
3. If the location of the program is in an exotic or far away site, teachers may be asked by their fellow teachers/administration or feel compelled to share the scientific information they learned with their peers or other classrooms.
 4. If the experiential program includes a significant amount of direct contact with the natural world, collaboration with peers, and support in a positive learning environment, teachers will walk away from the experience not only with increased science knowledge and pedagogy, but also an increased sense of purpose and morale for teaching.
 5. Finally, as discussed in the conclusion, many teachers want to do more after a program such as this, but they often feel constrained by their standards and feel as if they are unable to include more ocean literacy.

Chapter 5

FINDINGS, ANALYSIS, AND INTERPRETATION PART II:

Teachers' Conceptualizations of Ocean Literacy following Project ISLE

Introduction

The trends in teachers' conceptualizations of ocean literacy surround four main themes:

1. Teachers' conceptualizations are strongly influenced by the grade level they teach, 2. Ocean life can serve as a catalyst for ocean literacy development, 3. Project ISLE opened teachers' eyes to the reality of human impact on the oceans, and 4. Teachers believe the Hawaiian culture could serve as a model of ocean literacy for landlocked, mainland cultures.

As described earlier, my working definition of conceptualization combines teachers' beliefs and understandings about ocean literacy. In other words, I view a concept that a person holds as not only their implicit assumptions about a topic, but also the knowledge and factual information that influence that subject or topic. I saw this definition as the most appropriate because this is how the teachers seem to describe their concept of ocean literacy: They not only talk about what they "believe" to be true and important about the ocean, ocean stewardship, and literacy, but they also constantly mix in ocean science facts to back up their belief claims. Examples of this combination are available throughout the chapter for 11 of the 12 participants. Please note, that Philip's responses were removed from the results of the pre-assessment, since he was unable to participate in the post-assessment due to a family emergency.

Evidence of Teachers' Exposure to the Ocean Prior to Project ISLE

To provide an understanding of teachers' background experiences with ocean habitats, I included the following five, basic "Exposure" questions in the pre-assessment adapted from the Ocean Literacy Index (Marrero, 2011). These questions are by no means an extensive look into teachers' past exposure to the marine world and oceanography, but they do provide a basic context as to why teachers may believe and respond toward the ocean in one way or another. For example, Figure 5.1 depicts teachers' responses to the question "How often have you visited the ocean/coastline this past year?"

Figure 5.1:

Teachers' Responses to "How often have you visited the ocean/coastline this past year?"

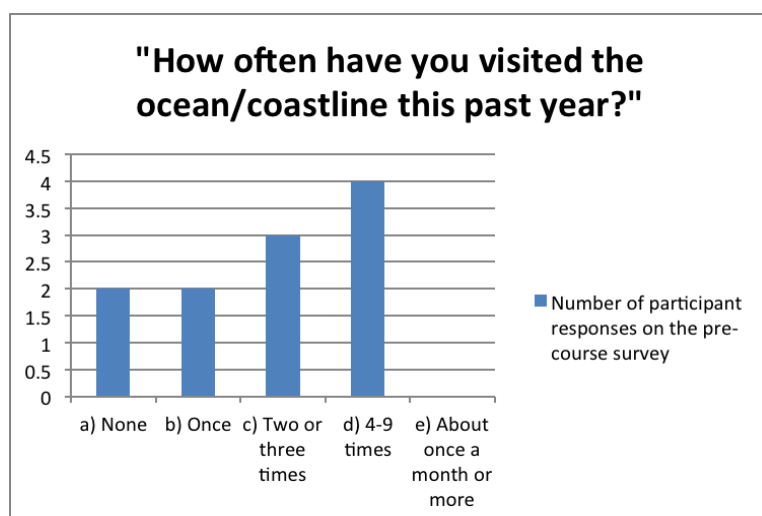


Figure 5.1 Teachers' responses to "How often have you visited the ocean/coastline this past year?"

Of the 11 teachers that participated in the pre-assessment here, only two had not visited the coast in the past year. In fact, most teachers (7) had made the 150-200 mile trip to the coast on more

than one occasion. Therefore, compared to many teachers in the mainland US, these teachers have had extensive experience with marine habitats in the past year alone (Pre-Assessment Data, May 25, 2011). On the other hand, Figure 5.2 depicts teachers' responses to "How often have you visited an aquarium in the past year?"

Figure 5.2:

Teachers' responses to "How often have you visited an aquarium in the past year?"

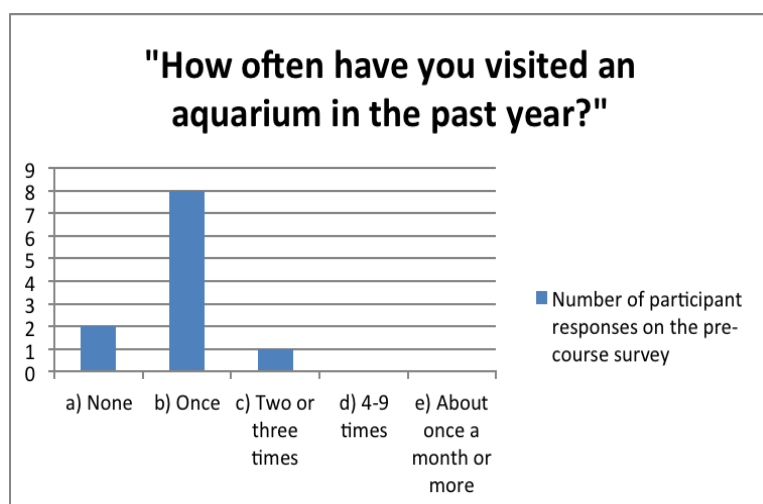


Figure 5.2: Teachers' responses to "How often have you visited an aquarium in the past year?"

In this instance, most teachers (8) visited aquariums only once in the past year. Therefore, a logical assumption to make would be that the majority of the exposure teachers' received in their trips to the ocean over the past year was most likely recreational in nature and may not have had a strong marine science educational focus. On the other hand, in Figures 5.3 and 5.4 in which teachers respond to "I visited the ocean often as a child" and "I visited zoos and aquariums often as a child" the teachers had almost the same number of responses in both questions indicating a balance of educational and recreational experiences with marine settings.

Figure 5.3:

Teachers' responses to pre-survey question "I visited the ocean often as a child"

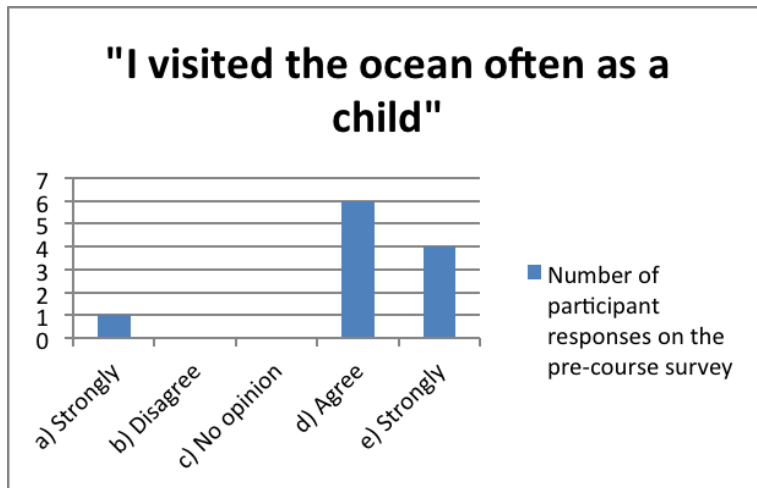


Figure 5.3: Teachers' responses to pre-survey question "I visited the ocean often as a child"

Figure 5.4:

Teachers' responses to pre-survey question: "I visited zoos or aquariums often as a child"

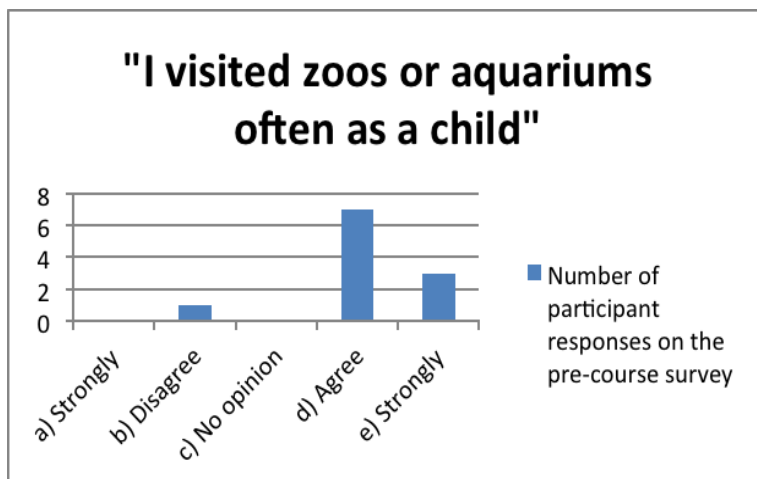


Figure 5.4: Teachers' responses to pre-survey question: "I visited zoos or aquariums often as a child"

Finally, Figure 5.5 depicts the teachers' attitude toward educational media about outdoor settings.

Figure 5.5:

Teachers' responses to pre-survey question "I like to read or watch TV programs/movies about the natural world"

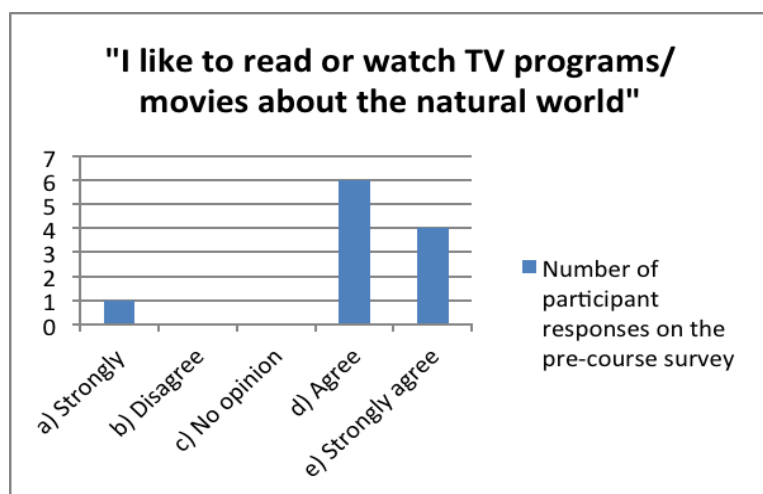


Figure 5.5 Teachers' responses to pre-survey question "I like to read or watch TV programs/movies about the natural world"

In this instance, only one teacher responded negatively to reading or watching TV programs about the natural world, indicating that the majority Project ISLE participants are open to learning about natural settings and may have participated in educational activities outside of formal schooling.

Evidence of Teachers' Background Knowledge before and after Project ISLE

Due to the qualitative nature of the data sources (in-depth interviews, open-ended surveys, observations, etc.) and the open-endedness of the research questions, an in depth,

statistical analysis of teachers' factual knowledge or conceptual change did not seem appropriate for this particular study, especially given the fact that the participants had such an immense range of scientific background knowledge and experiences. Still, I do briefly describe the differences between teachers' pre- and post-test scores in order to provide a basic understanding of teachers' knowledge of ocean literacy concepts based on the Ocean Literacy Index (Marrero, 2011). The Ocean Literacy Index was originally designed for k-12 students, so I altered the questions and illuminated several that seemed inappropriate for adults. The program instructors designed pre- and post-assessments to measure teachers' growth in terms of the content knowledge from the program as well as their attitudes, behaviors, and exposure to ocean settings. Of the 21 questions included in the assessment, 14 were clearly related to the ocean literacy essential principles, and many of those were adapted from the Index (See Appendixes I and L for full assessments). However, the 14 questions do not represent all of the seven Ocean Literacy Essential Principles (OLEP&FC). Project ISLE focused heavily on volcanology, astronomy, fish identification, and conservation, so OLEP&FC Number 2 ("The ocean and life in the ocean shape the features of the Earth") and Number 5 ("The ocean supports a great diversity of life and ecosystems") are the two most heavily emphasized principles in the assessment. Therefore, this assessment cannot be used to measure teachers' overall ocean literacy understandings, but rather their knowledge that pertains to the Project ISLE program. Given that the program was the focus of my research questions, including OLEP&FC questions unrelated to the program's activities would have been inappropriate. Table 5.1 portrays the content questions included in the Project ISLE program along with the number of teachers who answered correctly in both the pre- and post-assessments and the difference.

Table 5.1

Pre- and Post-Assessment Analysis

Analysis of Project ISLE Pre and Post Assessments--OL Content Only			
Question	Number of Participants who answered correctly on the Pre-Assessment	Number of Participants who answered correctly on the Post-Assessment	Difference
3) Which of these is true about erosion? (<i>OLEP&FC: 2c</i>)	7	10	3
4) Certain areas of Hawai`i have black sand beaches because of: (<i>OLEP&FC: 2d</i>)	1	9	8
5) Which types of living things are there the most of in the ocean? (<i>OLEP&FC: 5b</i>)	8	9	1
6) In which of these places would you find the most ocean life? (<i>OLEP&FC: 5f</i>)	2	9	7
7) Which of the following represents a problem that threatens an unusually large number of Hawai`i's marine and terrestrial species? (<i>OLEP&FC: 6e, 6g</i>)	3	10	7
8) Which of these reproductive strategies do parrotfish use? (<i>OLEP&FC: 5d</i>)	2	11	9
10) It is likely that the fish pictured below eats: (<i>OLEP&FC: 5d</i>)	3	6	3
11) The fish below is a: (<i>OLEP&FC: 5c</i>)	3	9	6
12) The lateral line in a fish(<i>OLEP&FC: 5d</i>)	4	9	5
13) Techtronic activity affects the ocean in the following ways: (<i>OLEP&FC: 2</i>)	7	7	0
14) The deep valleys found on the windward sides of the Hawaiian Islands are formed mainly by: (<i>OLEP&FC: 1b</i>)	7	8	1

15) Coral live in a very close symbiosis with: (<i>OLEP&FC: 5d</i>)	6	5	-1
16) The most important way to respond to threats to Green Sea turtles (aka Honu) is: (<i>OLEP&FC: 6g</i>)	7	10	3
20) Which science disciplines factor in to the study of oceanography? (<i>OLEP&FC: 7f</i>)	11	11	0
			Avg: 3.714286
Average of OL Content (14 possible points)	6.45	11.18	
Average percentage out of 14	46%	80%	

In all but two questions (Item #'s 15 and 20), the Project ISLE teachers' content knowledge improved in between the pre- and post-program assessments with an average improvement of almost four teachers per question (3.74). Figure 5.6 below depicts the same information in a graphic form.

Figure 5.6:

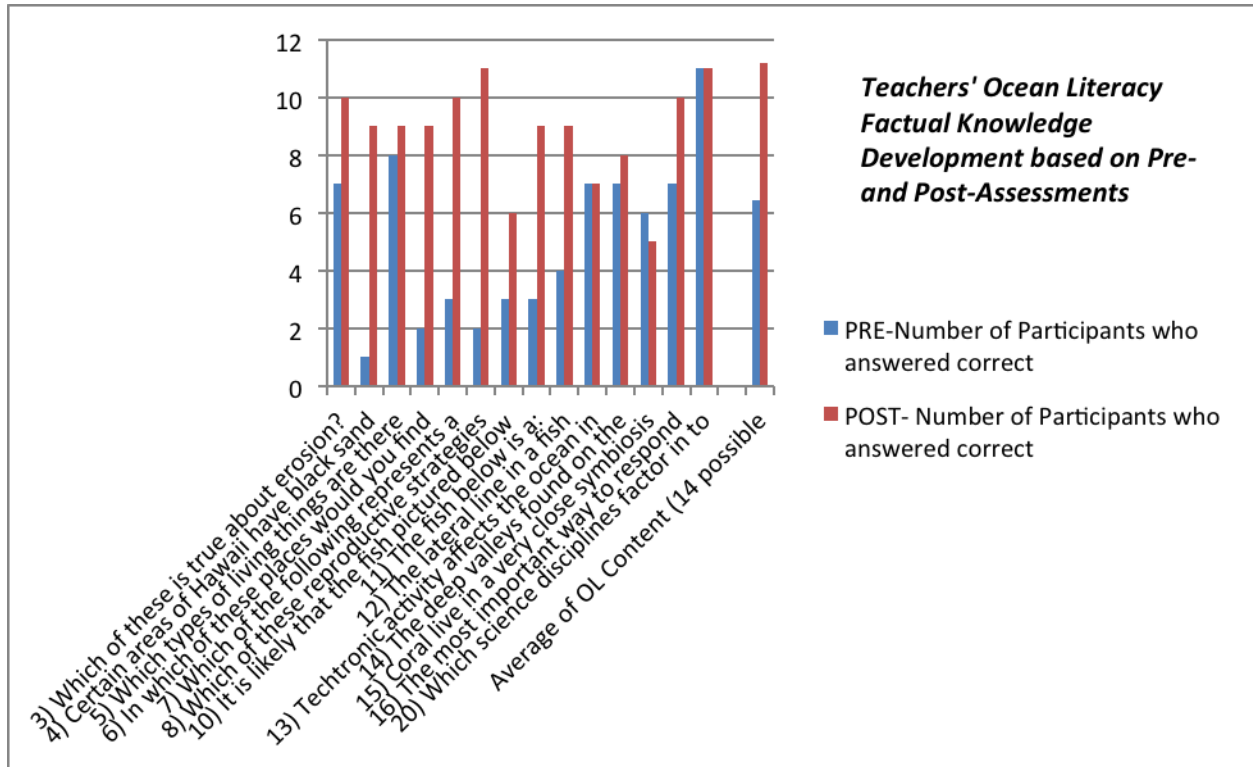
Pre- and Post-Assessment Analysis

Figure 5.6 Pre- and Post-Assessment Analysis

Teachers' Attitudes before and after Project ISLE

The following figures explain teachers' general attitudes toward the ocean and other natural settings before and after the Project ISLE program. For example, Figure 5.7 explains teachers' level of comfort in outdoor, natural settings.

Figure 5.7:

Responses to assessment statement "I feel comfortable in outdoor, natural settings"

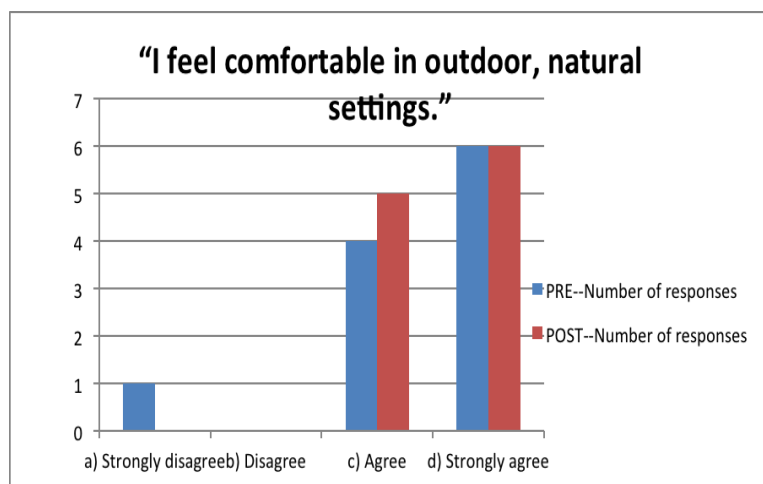


Figure 5.7 Responses to assessment statement "I feel comfortable in outdoor, natural settings"

All but one teacher, Lee, stated that they either agree or strongly agree to the statement that they feel comfortable in outdoor settings prior to Project ISLE, and all teachers responded positively after Project ISLE. However, one teacher, Marie, shifted her response from "strongly agree" prior to the program to just "agree" afterward, indicating that an aspect of the program may have made her feel less comfortable in outdoor settings.

Figure 5.8:

Responses to assessment statement “Each of us has a personal responsibility to protect the ocean”

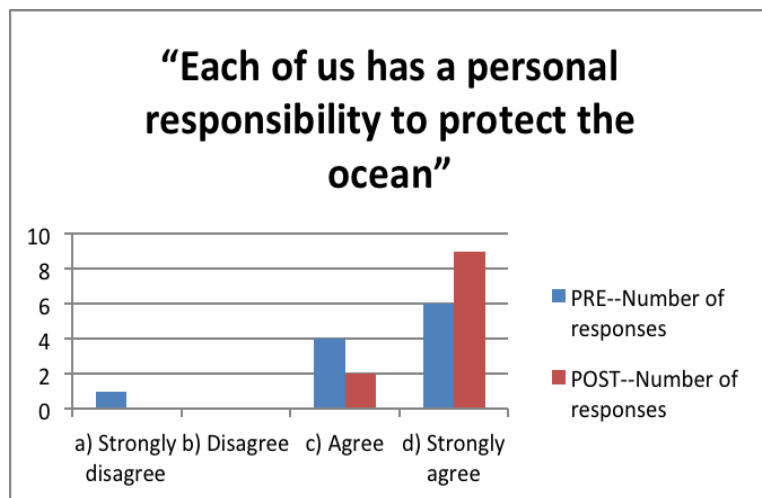


Figure 5.8: Responses to assessment statement “Each of us has a personal responsibility to protect the ocean”

As in Figure 5.7, Figure 5.8 portrays teachers’ mostly positive sentiments with regard to the following statement: “Each of us has a personal responsibility to protect the ocean.” In general, most teachers agreed that it was part of their personal responsibility to be stewards of ocean resources both before and after the Project ISLE program. However, 27% of the Project ISLE teachers changed their choice from either “agree” or “strongly disagree” to “strongly agree” following their experiences in Hawai`i, thus indicating that teachers felt a strong increase in their personal responsibility toward the protection of ocean resources. Again, in this instance, Lee was the only teacher to select “strongly disagree.”

Figure 5.9:

Responses to assessment statement “I have no effect on the oceans since I live so far from them”

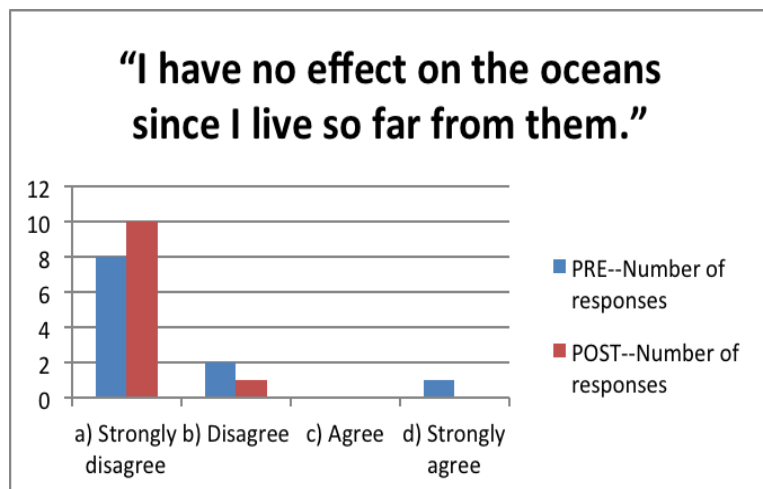


Figure 5.9: Responses to assessment statement “I have no effect on the oceans since I live so far from them”

Figure 5.9 above is a statement designed to challenge participants’ responses and ensure that respondents are not simply choosing “strongly agree” the whole way down to save time. In response to “I have no effect on the oceans since I live so far from them,” all but one teacher, Emily, understood before Project ISLE that their everyday choices do have an effect on the oceans, which is a basic ocean literacy understanding. After Project ISLE, all teachers except for one, Alissa, said that they strongly disagree with the statement.

Figure 5.10

Responses to assessment statement “I contribute to the problems facing the ocean”

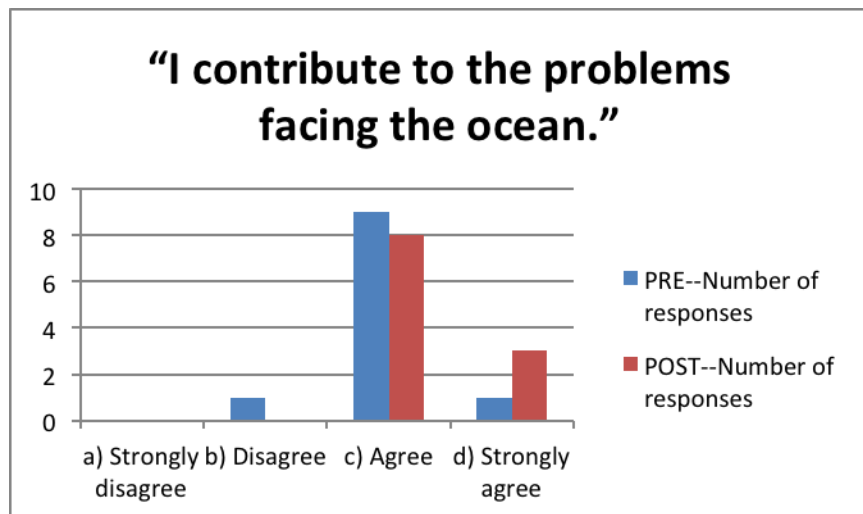


Figure 5.10: Responses to assessment statement “I contribute to the problems facing the ocean”

Similarly, Figure 5.10 provides teachers' degree of agreement concerning their contributions to the problems facing the ocean. Prior to Project ISLE, most teachers understood that their daily actions contributed to the problems facing the ocean. Carly was the only teacher to disagree with that statement before the program. Carly shifted her answer to “agree” following the program, and Emily and Amy shifted theirs to “strongly agree” following Project ISLE.

Figure 5.11:

Responses to assessment statement “I feel a sense of amazement and appreciation for ocean life”

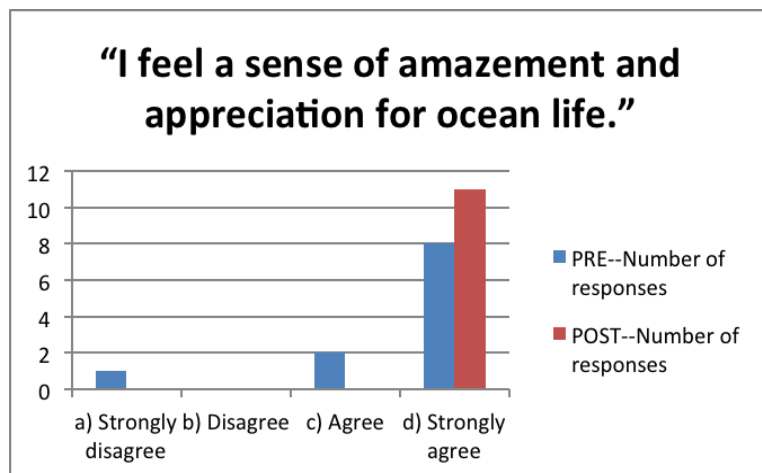


Figure 5.11: Responses to assessment statement “I feel a sense of amazement and appreciation for ocean life”

Finally, Figure 5.11 indicates teachers’ responses to the statement: “I feel a sense of amazement and appreciation for ocean life.” Before the Project ISLE program, most teachers stated that they strongly agreed with the statement, with Amy and Ashlyn responding with “agree” and Lee “strongly disagree.” However, all teachers responded that they strongly agreed with the statement after the program, indicating that all teachers felt a sense of amazement and appreciation for the ocean life they observed during Project ISLE (See Assertion 2 below).

Teachers’ Environmentally Friendly Behaviors before and after Project ISLE

We designed the third and final section of the Project ISLE assessment to gain a sense of teachers’ behaviors with regard to environmental or ocean-friendly habits. Also designed from the Ocean Literacy Index (Marrero, 2011) such questions provide an understanding into how

teachers put their knowledge of ocean topics into action in their daily lives. They also indicate the level of commitment to environmental issues. For example, in Figure 5.12 we asked the teachers to respond to the statement “How often do you make an effort to conserve water in your daily life.” Surprisingly, despite their relatively high exposure to ocean habitats and ocean-friendly attitudes described earlier, teachers were fairly spread out prior to Project ISLE with a third of the teachers responding “rarely” or “sometimes” in their pre-assessment. In the post-assessment, one teacher, Emily changed her answer from “rarely” to “often,” possibly indicating a renewed dedication to water conservation following Project ISLE. Similarly, Ashlyn, Virginia, Marie, and Lee all moved their responses down in terms of their frequency of water conservation following Project ISLE, possibly indicating that Project ISLE opened their eyes to the fact that their level of water conservation may not be as consistent as it could be.

Figure 5.12:

Responses to assessment statement “How often do you make an effort to conserve water?”

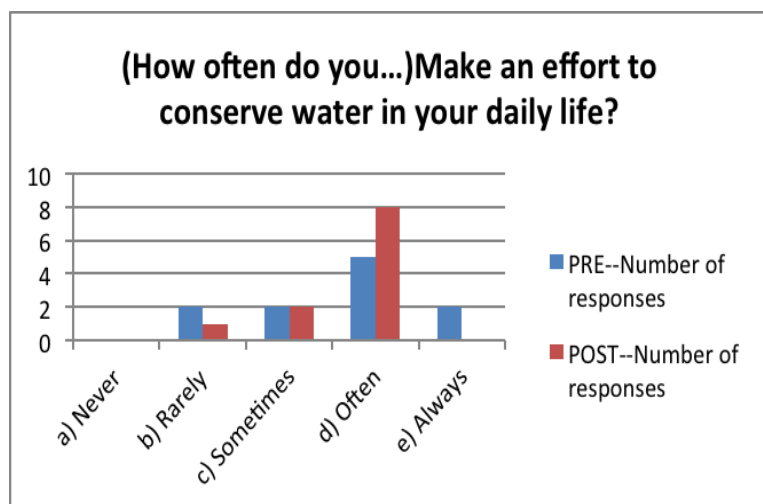


Figure 5.12: Responses to assessment statement “How often do you make an effort to conserve water?”

Similarly, when asked about the frequency with which teachers recycle (See Figure 5.13), teachers' responses were also spread out, with the most teachers responding "often." One teacher, Amy, stated that her recycling increased in frequency in the post-assessment, while Alissa and Judy shifted their responses from "always" to "often" possibly indicating another reality check with regard to their recycling habits following Project ISLE.

Figure 5.13:

Responses to assessment statement "How often do you recycle paper, plastics, glass and other materials?"

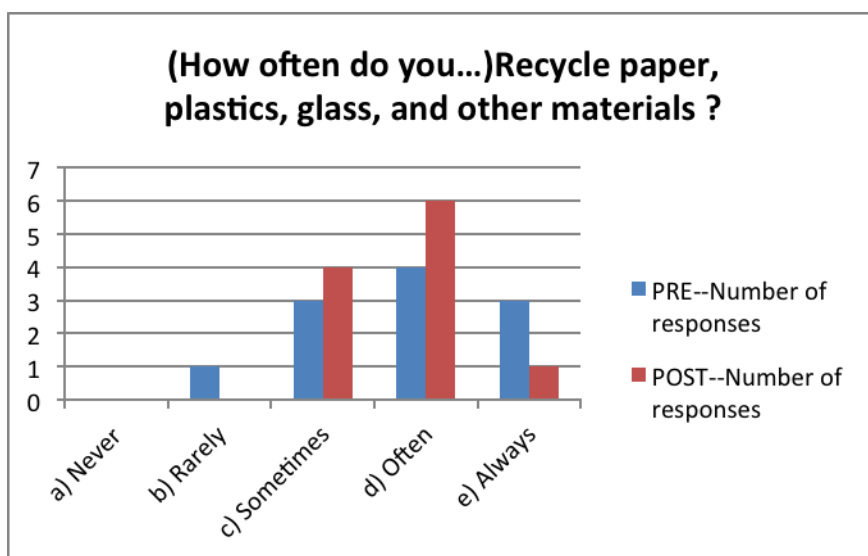
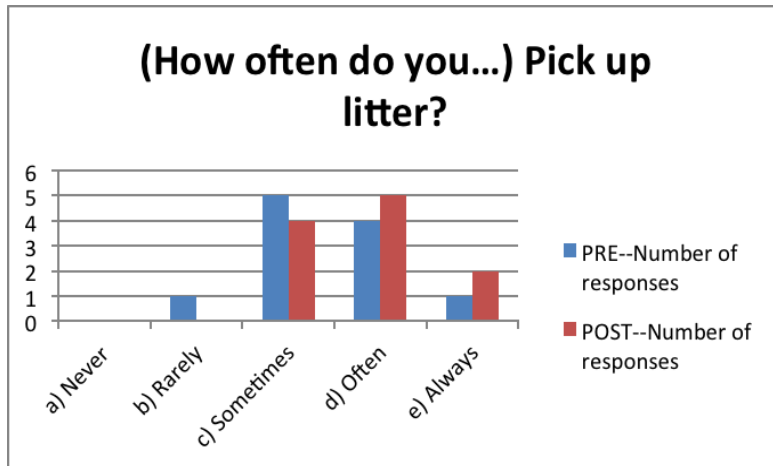


Figure 5.13: Responses to assessment statement "How often do you recycle paper, plastics, glass and other materials?"

Most teachers responded "sometimes" to the question "How often do you pick up litter?" (See Figure 5.14) on the pre-assessment, with one teacher, Marie, stating "rarely." Five teachers kept their responses the same between the pre- and post-assessments, but all of the other teachers

moved their responses up in frequency, with Emily making the largest jump from “sometimes” to “always.”

Figure 5.14:



Responses to assessment statement “How often do you pick up litter?”

Figure 5.14: Responses to assessment statement “How often do you pick up litter?”

Next, most teachers stated that they “rarely” avoided buying seafood that is overfished or caught/farmed in ways that harm the ocean prior to Project ISLE with the second highest category being “sometimes.” One teacher, Ashlyn, did not respond to this question in the pre-assessment. After the program, two teachers’ responses stayed the same, while six teachers stated that their frequency of cautious purchases increased. One teacher, Lee, shifted his response from “sometimes” to “rarely” following Project ISLE, indicating that he may not have been aware of his lack of ocean-friendly purchases prior to the program (See Figure 5.15).

Figure 5.15:

Responses to assessment statement “How often do you avoid buying seafood that is overfished or caught/farmed in ways that harm the ocean?”

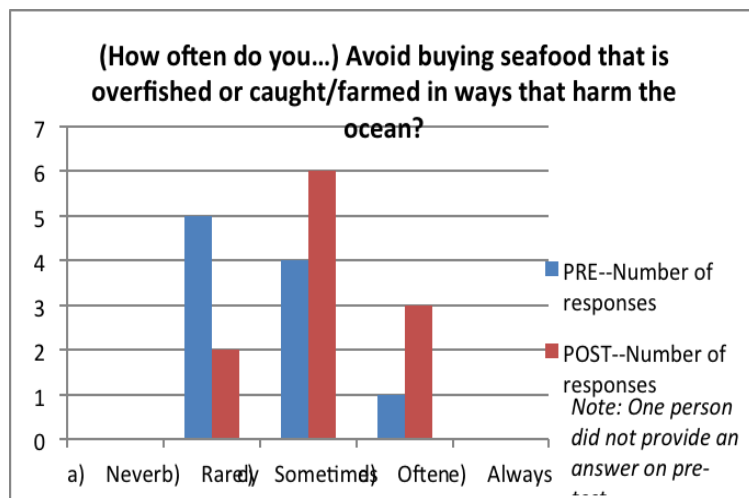


Figure 5.15: Responses to assessment statement “How often do you avoid buying seafood that is overfished or caught/farmed in ways that harm the ocean?”

Finally, all teachers either agreed or strongly agreed with the statement “I would support efforts to protect the marine environment, even if it meant paying more for seafood or closing certain beaches to the public” in both the pre- and post-assessments (See Figure 5.16). However, only three teachers’ responses stayed the same from the pre-assessment to the post-assessment (Emily, Judy, and Sarah). All of the other teachers either moved their responses down or up in terms of frequency. Also, Ashlyn did not respond to this question in the pre-assessment.

Figure 5.16:

Responses to assessment statement “I would support efforts to protect the marine environment, even if it meant paying more for seafood or closing certain beaches to the public”

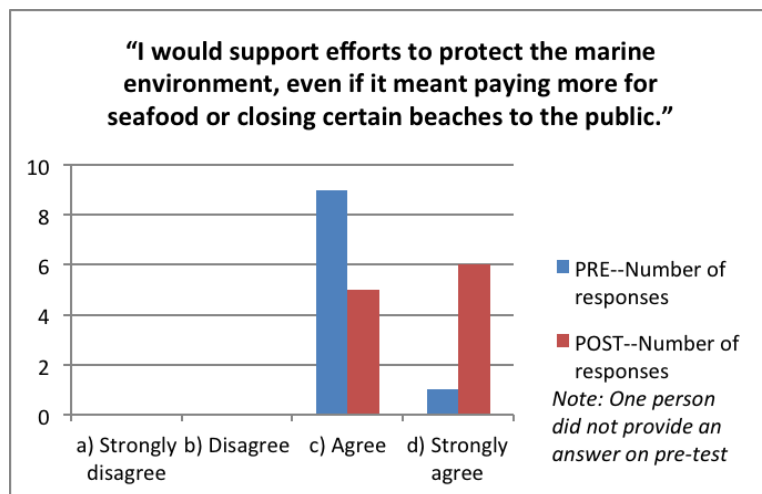


Figure 5.16: Responses to assessment statement “I would support efforts to protect the marine environment, even if it meant paying more for seafood or closing certain beaches to the public”

Implications for the Present Study

Based on these data provided, teachers have a relatively high exposure to oceanic settings and have positive attitudes toward the ocean. Many also practiced ocean-friendly behaviors prior to Project ISLE, but about one third of teachers did not, despite their positive attitudes and exposure. After Project ISLE, teachers’ responses generally shifted toward more positive attitudes and more ocean-friendly behaviors, indicating that the Project ISLE program improved teachers’ understanding of key ocean environmental concepts.

Description of the following Assertions

As in Chapter Four, I begin by explaining how the teachers' conceptualizations differed as a result of their backgrounds in either elementary or secondary education. On the other hand, the final three assertions show teachers' commonalities among all grade levels. For example, almost all teachers (10/12) expressed an increased appreciation for ocean life after having been immersed in oceanic habitats through activities like snorkeling and reef hikes, which then acted as a catalyst for ocean literacy development and appreciation. Teachers also claim that their exposure to marine issues during Project ISLE such as plastic accumulation in the oceans, habitat destruction, etc. helped them to appreciate the global impact of human activity on fragile marine ecosystems and developed a new or renewed desire to protect them. Finally, the concluding assertion describes how in-depth exposure to traditional views of the Hawaiian culture helped teachers combine their new admiration of marine ocean life and comprehension of human impact. Therefore, the researcher proposes that the Hawaiian culture could serve as a model through which mainland or land-locked cultures can better understand ocean literacy and that a curriculum that is embedded in the Hawaiian culture or other island/coastal cultures could assist mainland Americans in understanding what it truly means to "understand the ocean's influence on you and your influence on the ocean" (National Geographic Society et al., 2003).

Assertion Five: Teachers' Experiences and Assigned Grade Level Influence their Ocean Literacy Conceptualizations

In an attempt to understand teachers' conceptualizations about ocean literacy, it became apparent that teachers used their personal experiences, prior knowledge, and position within a specific grade level as lenses through which to view ocean literacy. In general, different grade level teachers seemed to have different responses to the ocean literacy material and activities

presented during Project ISLE. Elementary teachers as a whole seem to focus on the “literacy” side of ocean literacy while the high school teachers focus more so on the “ocean” side. The middle grades teachers’ were split between the two with one teachers’ descriptions coinciding more with the elementary teachers’ sentiments and another with the high school. The participants’ responses in this situation are logical due to the nature of the content they have to teach. For example, it is not surprising that elementary teachers who must teach reading and literacy would self-define ocean literacy as an ability to “read” the ocean, whereas secondary teachers tend to focus on the ocean science facts behind ocean literacy. Other general trends noticed were that elementary teachers seemed to focus on the experiences as a whole that they could bring back and share with students (stories, pictures, artifacts, etc.) Middle grades teachers seemed to want to expand their already existing standards-based units, and high school teachers seemed to want to improve their own science understanding

Elementary Teachers’ Approach to Ocean Literacy

Since most elementary educators tend to teach all subject areas, they approached the Project ISLE experience with a very different viewpoint than teachers who just taught science. For example, Marie’s initial conceptualization of ocean literacy was one of fear because of previously held self-efficacy beliefs that she was “not good at science,” but she later explains that Project ISLE helped her confidence in teaching ocean science and other Earth science subjects.

My initial essay was about not really being scientific at all, and not “getting” science. And then struggling in some of the concepts teaching my kids. And I definitely think I have a better understanding of all, I mean, Oceanography, Geology...But then I do also think that it...It’s always something that’s going to be tougher for me. It’s never going to come easy...I can teach third graders, but when we get into some physical science where I’m like...OK, I’ll teach you what the book says, but don’t ask me to elaborate. And I

think that I kind of chipped away on my fear and I chipped away on my lack of knowledge. I don't think that it's completely gone. I just need to work on it. I think it's going to be one of those, like, lifelong, I'm going to have to continue to fight the urge to...not do certain activities with them, or ...I don't know. It's almost like learning a language and you just continue, you have to practice at it (Interview with Marie, September 15, 2011).

In other words, Marie learned a lot, but she recognizes that she did not understand everything. Still, she seems to be OK with that fact, and did not sound as overwhelmed or anxious about a lack of science understanding as she did in her essay because ISLE helped her “chip away” at her fear of science and compares science teaching to language acquisition—implying that she believes becoming a skilled science teacher would take years of practice. Later, when asked to describe her own level of ocean literacy, Marie stated that she felt as if she were at the “beginner level,” but believes she is improving because, “I’ve changed my habits since Hawai`i... I didn’t even recycle before Hawai`i, and now I’m recycling” (Interview with Marie, September 15, 2011).

Although Marie was the only teacher to openly admit her fear of teaching science, other teachers voiced their concern for teaching ocean science in other ways by describing it as “overwhelming.” For example, when Amy gave her model lesson to the other teachers during the first week of the Project ISLE program, she admitted that teaching about the ocean was, “overwhelming, actually, for me. I taught math and math is much simpler and there’s an end. For me it seems like with this you could go on forever. You could spend all year teaching time on this” (Field Notes, June 12, 2011). She explained that when she had her students complete an assignment on the ocean, they got “really bogged down” in the section on composition because each ocean is so different: changing temperature, currents, flow, etc. Amy said her students were “freaking out because they didn’t know where to begin” and she did not feel adequately prepared

to help them tackle this massive topic (Field Notes, June 12, 2011).

Ashlyn was not alone in noticing ocean related topics in her everyday life after Project ISLE. In fact, several teachers explained how they did not realize that they were including ocean literacy into their lessons previously. For example, Virginia explained in her interview, “Honestly, I had not given much consideration to the topic of Ocean Literacy prior to this course” (Interview with Virginia, October 6, 2011). However, she also described extensive marine science problem based units concerning the Great Pacific Garbage Patch and ocean exploration in her previous teaching experiences, which are two topics very closely tied to the essential principles of ocean literacy. Still, Virginia explains that she does not feel her previous instruction was sufficient: “I can say that after participation in Project ISLE, I will make more of an effort to educate my students about their individual connections to the oceans and use it as an overarching theme as I teach other relatable topics (water cycle, solar system, ecosystems, adaptations, etc...)” (Interview with Virginia, October 6, 2011). As the curriculum coach for her elementary school, Virginia explained that based on the state standards for the elementary grade levels, she believed ocean literacy to be the “umbrella” under which the standards seem to fit. In fact, Marie was surprised at the amount of ocean literacy she was able to tie into her third grade classroom:

... I found that and the kids don’t know it, but in my head I’m like, “Ding! Ding!” you know, when we tie in [ocean literacy]...because it’s so much more than just the ocean, but what lives in it...cause I’ve done the biomes before and teaching the ocean biome separately. But I found this year, it’s so much easier just to...it just keeps incorporating itself. And I kind of laugh in my head, I’m like, “Of course it does, Marie. It’s, you know, 73% of the Earth’s surface, why wouldn’t it be a huge part of what you talk about (Interview with Marie, September 15, 2011).

Another trend with the elementary teachers was their desire to focus on the positive things humans can do to better the ocean environment, as opposed to the “gloom and doom” that

inevitably comes in a discussion of the ocean-human relationship. Many of the elementary teachers walked away from the Project ISLE experience wanting to help their students feel empowered to be ocean stewards. For example, Virginia described how she was encouraged by all of the Project ISLE speakers who made it their life's mission to protect Hawai'i's wildlife. I was also encouraged by the ways people advocate for animals whether they are volunteers (sea turtle trackers and helpers) or employees at an aquarium or whale sanctuary...I am always trying to teach my students the power of one single person and the changes they can inspire in others. (Virginia, Post-program survey). Carly explained in her post-program survey that she believes strongly in student advocacy:

A student who is aware and educated on how to help the Earth can get kids excited about helping keep our Earth and oceans clean. If they are aware of the damage being done can only help them improve what will happen in the future and help fix the past... I feel that it is very important to educate the youth about how they can help and change the future. They can take what they learn and believe and pass their knowledge onto family members and friends and get others aware (Carly, Post-program survey).

Emily agreed with this feeling and said, "From this point forward, my curriculum will include much more emphasis on environmental literacy and will require action plans from my students when we discuss real-world examples of what we as citizens can do right now to help our depleting wildlife" (Emily, Post-program survey). Sarah described in her interview how she too makes an effort to help students find a love for ocean wildlife first, so that when they discuss ocean pollution and marine debris later on, "it really hits home...You know, you as a six year old can make an impact on the ocean. And to teach them those things is...I think it reaches them, and they understand" (Interview with Sarah, October 7, 2011).

Despite her statement of dedication to ocean advocacy in the post-program survey, Emily struggled to provide even one example of how she was using ocean literacy material in her first

grade classroom. In fact, the example she did provide was one concerning another trip she took to Yosemite National Park, and not Project ISLE. She explained later that this particular group of students was a more challenging group in terms of their behavior than she has ever had. Therefore, she felt as if her class was behind and had to “catch up” with the other classes and that she did not have time to do her Hawai`i unit until the next semester. Therefore, it seems as if these teachers believe that ocean literacy requires additional work and effort. Also, they explain that they view ocean literacy instruction as at least somewhat contradictory to their standards even though two of their colleagues from the Project ISLE trip teach the same grade levels/subjects and do not share their sentiments.

However, among all of the conceptualization trends noted among elementary teachers, the strongest and most predominant trend pertained to their status as literacy instructors. Due to the fact that elementary teachers help students learn how to read, they have a higher level of appreciation and experience for teaching students how to read. This experience with reading literacy influenced the way in which elementary teachers understood ocean literacy. For some teachers, they thought ocean literacy was simply the ability of students to read ocean science topics. For example, Emily defined ocean literacy in her interview as, “Being able to read the oceans, basically. If you really kind of break it down into what it means: “Literacy” is being able to read and understand how they affect all aspects of our lives and how ...what we do affects them even though we’re not near them” (Interview with Emily, October 7, 2011). Ashlyn agreed with this statement in her interview, “See when you say literacy I think of more like...handwritten knowledge. But really, ocean literacy is the ocean speaking to us. It’s everything that lives in [the ocean] speaking to us. Right? Because when you hear the word literally, literacy, this is what you think of (*points to the consent form she signed prior to the*

interview, indicating “text”) (Interview with Ashlyn, October 6, 2011). Marie also explained that she thought ocean literacy concerned reading but has since expanded her understanding:

In the beginning, my definition was very basic: reading about oceans. I now understand that 'ocean literacy' encompasses so much more. It is being educated and knowledgeable on the oceans, sea life, pollution, threats and conservation. I think it also alludes to our part as humans in trying to conserve this resource as well... I didn't see the importance of ocean literacy, nor truly understand the phrase. I thought that teaching oceans meant large marine animals and colorful art projects. I feel like a door has been opened to the true meaning of this term (Interview with Marie, September 15, 2011).

Despite their knowledge of what the official definition of ocean literacy is, some elementary teachers struggle to get beyond the notion of literacy as “reading.” For example, when asked to define ocean literacy in her own words, Sarah said “...educating others about the animals that live in the ocean, how we need to take care of the ocean, and make it enjoyable for years to come...” (Interview with Sarah, October 7, 2011). Later, when asked to describe her own level of ocean literacy, Sarah explained,

I would say...It's, um, you know from a one to a ten a nine, I mean, I really feel like...you ...you know, kind of where we are, what we're going to be studying, even the wind on the side...you know, where we would be. And my dad was really familiar with Maui...I didn't really know that much about it, and then once I knew we were going, I knew and I called my dad, and he was like, “You didn't tell me you were going there!” And I did, and I just want to *read!*...When we were at the ocean...when we would study the Wailea Park—remember when we met Russ outside? I googled it and I wanted to know, like, what fish were there? What were we going to see? But you remember the beautiful grassy lawn. So there was a park sign, I actually took a picture of it and I started googling on my phone...Pulling up all my facts. And I was like, well look, the girls want to just sit by the pool, but I really just want to snorkel and you can go right here and to that beautiful beach...So, I would say a 10 because I love reading and I love learning.

In other words, because she felt completely comfortable reading about the ocean and ocean science topics, then that makes her ocean literate in her eyes. So despite the fact that she knows the definition says “Understanding the ocean's influence on you and your influence on the

ocean” (National Geographic Society, 2003), she still believes strongly in the literacy (reading) part of the term.

High School Teachers’ Approach to Ocean Literacy

The Project ISLE high school and two of the middle school teachers seemed to view ocean literacy as at least partially synonymous with oceanography. High school teacher participants expressed views or described views of ocean literacy that were based on knowledge of science facts (oceanography/environmental). When asked to elaborate beyond a definition in their own words, secondary teachers’ views did not embrace the interrelationship between humans and the ocean for which ocean literacy calls. Therefore, it seems logical to assume that teachers whose content is purely science may struggle with viewing ocean literacy as a relationship and gravitate toward an understanding of ocean literacy as fact based, scientific, and measurable. Secondary teachers seem to feel extremely confident in their knowledge, possess a hunger for oceanic scientific knowledge, and can become frustrated if asked to participate in learning activities they view as irrelevant to their classrooms.

First, most of the secondary teacher participants were self-assured in their scientific knowledge and demonstrated this in their questions during activities and their descriptions in interviews. For example, when asked if Project ISLE influenced their definitions of ocean literacy they all said that their beliefs about Ocean Literacy did not change drastically as a result of their Project ISLE experiences. Alissa said that Project ISLE did not affect her personal definition of ocean literacy, but she felt as if she understood the term more deeply and provided examples scientific facts as evidence of that. However, later in the interview, Alissa admits that she had not heard of ocean literacy was when she took her pre-program survey and performed an Internet search for the term. Judy also said that she’s, “always been really into marine science

and you know...So I was pretty aware going into it, but...It like reinforced what I felt already” (Interview with Judy, September 15, 2011). In her pre-program survey, Judy responded to the question based on whether project ISLE described her strong “sense” of ocean literacy that she believed she already possessed due to her previous scientific experiences. Lee described his previous experiences in marine science professional development as evidence for his pre-existing ocean literacy, and he also said that Project ISLE only influenced his definition a little bit. Additionally, all of the secondary teachers except for Alissa believed that their own levels of ocean literacy were either high or moderate because of their extensive scientific backgrounds.

Secondary teachers all seemed to relish in the scientific learning taking place and were constantly eager for more. In fact, when asked in an interview what they would change about the program if they were in charge of an ocean literacy professional development course, all of the high school teachers gave the same two answers. First, they would have liked additional scientific fieldwork, and they wished that the program had been tailored to high school teachers so that the level of scientific instruction could have remained consistently at the advanced level. In terms of fieldwork, Alissa explained that she would have enjoyed doing water quality testing at the different beaches we went to in order to better understand the human impact of that area. Alissa and Lee both suggested that if they were in charge of the program, they would ask the teachers to do a biodiversity analysis of the reef to count how many invertebrates an area housed.

Secondary teachers also felt frustrated at certain points in the program when they believed the scientific instruction was not sufficiently challenging or when they believed the material to be tailored to lower level teachers. Lee explained these sentiments in his interview:

I mean, a part of it is when you have a mixture of elementary, middle and high school all together...I would love for it to just be a high school group going out because it would have been a different level of information that would be presented to us and then having

...So I guess my only drawback from it was some of the stuff was, “Ok, this was neat. But it was for the elementary school teachers” (Interview with Lee, October 12, 2011).

Alissa and Judy both confirmed Lee’s sentiments and added that having additional high school teachers there would have made collaboration easier for them, thus amplifying not only the scientific but pedagogical experiences for them. However, all of the high school teachers followed these statements with statements of their appreciation of the program. Judy explained how she thought, “all of our speakers were phenomenal...I loved every single one of them...I think we did a lot of great things and we saw a lot of great things, so I was overall completely satisfied with the trip” (Interview with Judy, September 15, 2011). Alissa took her appreciation to an even higher level. When asked to describe the program in her own words, Alissa said,

I would say that it was a...um, I would say that it was a ...in-depth immersion into cultural and climatic aspects everything about Hawaii. It was *not* a vacation. (*Laughs*) It was a... wake up at the crack of dawn and go until the end of the day and get...and just consume as much as you could about Hawaii and it was...amazing. I love learning. I miss being a student, and I love that I’m in a career that I can keep learning, so that was just like...heaven. (Interview with Alissa, September 15, 2011).

Finally, the scientific focus described earlier in high school teachers’ hunger and confidence in science was also evident in their general descriptions of ocean literacy. When asked to define ocean literacy in his own words, Lee said, “...I would say that ocean literacy is a ...an understanding of how the ocean works for the flora and fauna and the nutrients that go into the ocean and how us as humans play a role in that ...in that interaction. Whether we live near the ocean or away from it” (Interview with Lee, October 12, 2011). In other words, he believes ocean literacy means knowing oceanography and how people affect the dynamics of the ocean. Similarly, when asked to describe their views of ocean literacy as a curricular topic in the post-program survey, the high school teachers unanimously said that it was an important topic, but only in certain classes. This is a far cry from the claims of the Ocean Literacy Network who

purport that it can and should be included in any science classroom due to ocean literacy's interdisciplinary nature. The Project ISLE high school teachers think differently. For example, Alissa stated, "I believe ocean literacy would be a valuable topic in a life sciences course such as environmental science, oceanography and biology" (Post-program survey). Lee's response to this question included ocean literacy with environmental literacy: "I think environmental literacy (including ocean literacy) should be taught at a high school level for all students. What's more, Alissa almost quoted the official definition for ocean literacy earlier in the interview, and yet when asked to describe her own level of ocean literacy she still describes her level of oceanography:

On a scale of one to ten—one: having no knowledge of the oceans, and ten being: put me on a boat I know everything about the ocean. I know what organisms live here what everything about it, the salinity, everything. I think I'm about a three to a four. I feel like I know ocean levels. I definitely know the different oceans, but I don't feel like I have really ...dived into understanding oceans and all there is to know about them.

In other words, this Alissa knows what the ocean literacy definition says, but she still believes ocean literacy is synonymous with oceanography.

Middle Grades Split Conceptualizations of Ocean Literacy

The middle school teachers' responses were somewhat split between the other two groups. Overall, the middle grades teachers seemed to focus on how they could include the information in Project ISLE into their pre-existing standards-based units. Also, like the high school teachers, they were fairly confident in their oceanography understandings. However, they did not seem to possess the same hunger for more science than what was already provided in the Project ISLE program. Also, their descriptions of ocean literacy did not really fit well into either the literacy-focused elementary group or the science-focused high school group. Additional research would be required to determine middle school teachers' tendencies toward ocean

literacy because the two teachers who remained in the program the entire time had very different views.

Even though Lisa and Amy both taught sixth grade Earth Science, which is a subject that naturally includes a significant amount of ocean science instruction, their approaches to ocean literacy instruction seemed to differ dramatically. As described earlier, Amy saw ocean literacy instruction as overwhelming and something that she tends to “put on the back burner” in terms of importance in her classroom behind more important standards. Despite having an ocean science standard in her curriculum, Amy responded to a question about the role ocean instruction plays in her classroom by saying, “Not as much as it should. It is hard to fit all the state standards into a year; adding them is a very rare opportunity” (Amy, Pre-program survey). On the other hand, Lisa said in her pre-program survey and her interview that she “never really leaves” ocean literacy in her Earth Science classroom.

Yeah, you know even if you look at Astronomy, talking about what is it that makes our earth special? Why can it support life? By understanding those oceans... We had really that whole year... always found our way back to oceans... We haven't found life anywhere else so far... yeah, that's where it all starts... We talked about weathering, deposition, and erosion, then we talked about waves, currents and tides in that particular unit. Then we talked about weather and the ocean plays a huge part in that, and we talked about the rock cycle, and what part the... and we talked about the ocean floor and the movement of the ocean floor and where these plates meet. You have these deep ocean trenches, and yeah... the deepest part of the oceans and ... we really never left it. And we won't this year. I mean... maybe that's why I love teaching Earth Science. I haven't always taught Earth Science, but maybe that's why I like it because I love the oceans so much. It's just very interesting to me. It's what captivates me as a teacher (Interview with Lisa, September 7, 2011).

In other words, Lisa's classroom sounds as if it was fully infused with the ocean literacy essential principles even prior to Project ISLE. However, in her concluding remarks Lisa explained that a big part of the reason why she applied to participate in Project ISLE was to learn

more about ocean literacy: “And one of the reasons I wanted to participate in this whole experience is to increase my awareness of not only just Earth Science but the ocean literacy was very attractive to me too. You know when you made your presentation in February. That was very intriguing to me.” In her interviews and surveys, Lisa consistently described extensive experience with the ocean throughout her life, which Amy did not include. Perhaps their differing background knowledge and exposure to oceanography and environmental literacy caused their ocean literacy stances to diverge so drastically. Additional research would be needed in this area.

Conclusion to Assertion Five: Teachers’ Experiences and Assigned Grade Level Influence their Ocean Literacy Conceptualizations

Because of the teachers’ varying experiences, personal backgrounds, and scientific knowledge, they approached the topics addressed Project ISLE and ocean literacy differently. High school teachers’ detail-oriented and somewhat competitive nature when it comes to science causes them to view ocean literacy through an oceanography lens first and foremost. Elementary teachers’ experience with reading instruction combined with their fears of teaching science and hesitancy toward nature cause them to focus on the “literacy” side of the term. Finally, the middle school teachers in this study seemed unresolved as a group in their ocean literacy instruction. Table 5.2 below portrays teachers’ responses to the pre-program survey question, “Please describe your personal opinions or beliefs regarding the value of Ocean Literacy as a curricular topic.”

Table: 5.2

Responses to Pre-Survey Question “In your opinion, how important is it for students at your school to gain knowledge about the oceans?”

	OL is important for all students to learn	OL is no more important than any other science topic	OL is important when it works with the standards I’m teaching	Other
Name:	Carly, Marie, Emily, Virginia, Lisa, Amy	Lee, Judy	Philip, Alissa	Ashlyn
Total:	6	2	1	1

With the exception of Ashlyn, the elementary and middle school teachers all believed ocean literacy to be an important topic for all students. Similarly, becoming literate to read text is also crucially important for all students to learn. On the other hand, the high school teachers and one of the middle school teachers stated that ocean literacy is best learned in certain settings and is equally as important as all of the other sciences. In other words, they believe it would be inappropriate for certain educators to teach ocean literacy, just as it would be inappropriate for a language arts teacher to teach science facts like the formula for photosynthesis.

Assertion Six: Ocean Life can serve as a Catalyst for Ocean Literacy Appreciation and Development

Although teachers may have anticipated their feelings about some aspects of the Project ISLE program, many were surprised by their level of interest in others, especially their level of interest in ocean life. What’s more, this interest and enthusiasm seemed to serve as a catalyst for teachers’ ocean literacy development. Teachers expressed enthusiasm for ocean life as a result of their experiences on ISLE and this enthusiasm sparked a desire to learn more and share with others. The section that follows explains teachers’ sentiments toward Hawai‘i’s ocean life before

their ISLE experiences, on the islands, and how the experiences influenced their development and appreciation for ocean literacy after the trip's conclusion.

Snorkel Experiences and Teachers Reactions

Throughout the two weeks in Hawai'i, teachers had the opportunity to snorkel on five different occasions: once near a historical site known as the City of Refuge on the Big Island, and four other times on Maui. After the initial snorkeling experience, teachers' reactions were very enthusiastic. All four of the teachers who kept blogs raved about their experience to their followers. For example, Alissa's post had some enthusiastic reviews of the experience and included a few of the species names that she knew: "the reef was beautiful! And we saw so many fish. The yellow tang was everywhere! ...I think my favorite fish I saw was the parrotfish. A beautiful blue and green fish. Some were very large...up to 12" (Blog post, Alissa, June 11, 2011). Marie's description of the event was detailed and story-like:

Just snorkeled. I thought I was swimming in a saltwater tank. The fish were so bright and colorful...As we swam, there was loud crackling, which was parrot fish eating the reef. Virginia and I went on a mission to find sea turtles...And we snorkeled, and snorkeled, and snorkeled...and did not see any sea turtles. Utterly discouraged and frustrated, we begrudgingly got out of the water, not very gracefully. As we moped towards our towels, we saw the rest of the crew in a small bay. Immediately, they started yelling to hurry! We went charging in and alas, there were the turtles! I can't begin to describe how amazing it is to swim with a turtle half the size of you...absolutely amazing. Great, great day!" (Blog Post, Marie, June 11, 2011).

Emily's enthusiastically described her experiences with the sea turtles and snorkeling as "the best day ever" in her field journal (See Figure 5.17). She explained, "... I saw some amazing parrotfish and angelfish. But nothing compared to swimming with a sea turtle half your size! It was so incredible, I was giddy from it!! It was a feeling like no other" (Emily Field Journal Notes, June 11, 2011).

Figure 5.17:

Emily, Field Journal Excerpt, June 11



Figure 5.17: Emily, Field Journal Excerpt, June 11. Descriptions and notes recorded by Emily on June 11 during/after exploring the volcanic black sand beach of Punalu'u and snorkeling.

Even Lee who consistently maintained a science-should-be-taken-seriously attitude let his guard down somewhat with regard to this snorkeling experience in his field journal:

... the experience was unbelievable... I got to go into the somewhat murky and wavy waters to swim with the turtles... Their elegance is something to behold. Though from the surface it almost looks like they are playing in the water, they were actually eating and getting tossed about in the waves... We then went to a bay to snorkel which was fun. I got to go swim with another turtle and a ray. I also really enjoyed watching people who have never snorkeled get in the water and how much joy they have (Field Journal, Lee, June 11, 2011; OLEP&FC 5c, 5d, 6c).

Later that week, both Sarah and Philip purchased fish identification materials to amplify their snorkeling experience. For example, in my field notes for June 12, I mentioned, "Philip came up

to me a few minutes ago asking to stop at the visitor's center to buy a marine biology book. He said he wasn't going to buy one, and then after snorkeling yesterday, he decided he wanted one so that he would be able to say more than just 'I saw a yellow one.'" Similarly, Sarah purchased a waterproof fish ID card that she could take with her on her next snorkeling excursion.

Although the snorkeling experience described above was the only one on the Big Island, the teachers had several other opportunities on Maui. Also, due to the marine-focused nature of the instruction on Maui, teachers had an opportunity to move from fish spectators to marine participants. At the conclusion of the first full day on Maui, a representative with a local reef-watch program came to camp to present a slide show of the local fish species so that teachers would be able to identify them the next time they snorkeled. Prior to the next snorkel experience, several of the teachers practiced their new knowledge by quizzing one another: "Judy was already pretty good at ID'ing the fish so she quizzed us. After studying for 20 min or so, we went in! I recognized so many fish! I could see a fish and give a name to it. I snorkeled out on the reef for a half hour" (Blog Post, Alissa, July 9, 2011).

Teachers Overcoming Fears of the Ocean

Despite their answers in the attitudes section of the pre-assessment, several teachers were very nervous and hesitant to go snorkeling. For example, before the first snorkeling experience, several of the elementary and a few of the middle school teachers acted very nervous taking a long time to get their gear on, asking a lot of questions, and spending more time above water adjusting their gear. Virginia, Ashlyn, and Emily seemed the most nervous, so I "tried to distract them with showing them the fish and other things. Virginia said that she [distracted herself from

her fear by] focusing on the noise of the fish nibbling away at the coral (something I showed her). Ashlyn was the only one that wore the life preserver” (Field Notes, June 11, 2011).

In her interview, Ashlyn described this fear, “Yeah, the depth just scared the living daylights out of me. It fascinated me. It was clear. Clear as can be...but dangerous. Dangerous because the whatever on...what were those spiky things? The urchins...” After this initial snorkeling experience, the teachers confidence seemed to increase. For example, by the end of the experience, Ashlyn felt confident enough to snorkel without her inflatable snorkel vest, and she believed she could feel the waves and surface currents more profoundly, which was a meaningful experience for her: “I went snorkeling, and I wasn’t wearing the floatie! I went floatie-free, and so I was using my own self! And for some reason...now without the floatie, I really felt the current more” (Interview with Ashlyn, October 6, 2011). Similarly, Sarah squealed in fear when she first saw a little beach lizard on Maui. Later in her interview, Sarah explained that although she viewed the lodging on Maui as less than desirable, she described feelings of appreciation of the incident: “I’m a Sheraton girl, but I’ll say that was awesome. I was happy and it brought laughter and we had so much fun” (Interview with Sarah, October 7, 2011). Sarah also explained her fear during snorkeling and compared it to a previous snorkeling experience in the Caribbean:

...I couldn’t get over when I was going to Hawaii, I was like, “Hello Pacific Ocean!” I mean, we were on that little ledge and I was like, “We’re going to snorkel in there?” I was like, “That’s the ocean!”... “I don’t know that I can do this!” You know? And so, anyway, when I did I was like, “This is so awesome!”...We did this like in the open ocean! I mean, it was like wild!” Because you can’t picture standing there and what the world of beautiful things are going to be underneath you. I mean, at Trunk Bay, I mean at the first place I ever snorkeled, you could see because it’s quiet, it’s calm, it’s sunny, it’s turquoise, I mean, you can see what you’re getting into and you could see the little snorkelers everywhere. I mean, at that place it was rough waters, and it was windy, and it was dark, and you just didn’t know what you were going to see, and when you put your face in, it was like “Ah!” (Interview with Sarah, October 7, 2011).

Sarah later explains that she was so proud of herself, she called her father after the experience and told him of her accomplishment and that she had conquered her fear. In other words, these descriptions from Ashlyn, Virginia, and Sarah point to a fear that they may not have taken into account when answering the question on the pre-assessment that they “feel comfortable in outdoor/natural environments,” and that swimming in deeper ocean water was at least a little frightening for them. Although they were all strong swimmers and we provided safety vests for each of them and reassured them that snorkeling was safe, these teachers still held fears of the ocean and its inhabitants prior to the start of the program. However, in their interviews after the program, they expressed a sense of accomplishment and self-satisfaction at having conquered their fears, and a new and steadfast love and appreciation of ocean life and its preservation. For example, in an email received after the program’s conclusion, Ashlyn said: “I am in Amelia visiting my mom and of course the beach...Beach conservation is dredging the beach so that it will protect the coast...I am curious as how they are protecting the south end of the island where your lovely turtles come every spring. I used to not be that interested but I am now. Very!” (Email Received July 8, 2011).

Teachers’ Surprise at Enjoyment of Ocean Life

Following their experiences snorkeling, many teachers expressed a feeling of surprise at their level of enjoyment. For example, on the final day of the program, Lisa explained in a group discussion, “I was least excited about the fish and snorkeling, and *that’s* what got me the *most* excited!” (Field Notes, June 20, 2011). Alissa agreed with Lisa’s sentiments in her blog:

Day 15: Something’s fishy about Hawaii

I have to be honest. I wasn’t excited about learning about reef fish at all. Fish have never really been my thing. Before now, they all just kinda look the same to me...Big one, small one, black one, yellow one, stripey one, etc etc.

Today was a full day of snorkeling/ fish observations. I went into it thinking I would just have to endure it, but by the end of the day, I was so into it!!!” (Blog Post, Alissa, July 9, 2011).

Virginia was also surprised by her feelings: “...snorkeling was so wonderful, and I didn’t expect for that to be my favorite part, but I really looked forward to every opportunity to do that”

(Interview with Virginia, October 6, 2011). Similarly, Ashlyn thought that a intertidal invertebrate transect activity was going to be dull, but her enthusiasm afterward astonished her:

“...I even loved that dude that took us out and did (*drew a picture of the transect tool used during the rocky intertidal zone transect*)...I thought it was going to be boring as hell...I loved it.

What a great, fun thing. Because it all looked like sea weed, but really when you break it down, what are you really seeing?” Ashlyn enjoyed the discovery of a hidden world of invertebrate organisms that she had completely overlooked prior to her participation in this activity.

Excitement to Share Ocean Experiences with Students

This new found enthusiasm translated to excitement and eager anticipation to share their experiences with their students. For example, in her interview, Emily explained that the inspiration for her unit came from these experiences: “But mostly, my favorite part was the ocean literacy and all of the ocean life and everything that we learned [at the Marine Sanctuary]—that was my favorite day...I loved all of that. That’s why I wanted to focus so much more on the animals and the environment more than the culture [in my unit]” (Interview with Emily, October 7, 2011). Lee also found ways to include ocean fish into his high school chemistry class. He created a game to help students understand stoichiometry and unit conversion. In his interview, he explained why he wanted to include the fish in this way: “And so when I was in Hawaii I was like, ‘Oh let’s use Hawaiian fish because I can get the pictures of these and I can actually speak intelligently on what these fish are to the students’” (Interview

with Lee, October 12, 2011). When asked how his students reacted to the change, Lee explained,

They did a really good job. This was actually one of the better years I've had in them being able to do conversions so they enjoyed that activity and I think that activity overall helped lead into a...better lead into how we do conversions. And that was I was able to relate back to it and say, "You know, what do we put here?" So it's writing down units, which I made them write down all the fish names every time and it's the whole concept of converting units using the ...them Mitchell analysis process. It just...it seemed to click better...It seemed to work, so I'll definitely be using it again next year.

In the follow up meeting and group interview, Sarah described how her contagious enthusiasm for the sea turtles caught on with her students, and she now has an entire sea turtle-themed curriculum:

I have a puppet that I bought at the aquarium [that] I got [with] this book that's Baby Honu's Journey ... I shared one of my turtle [pictures with the book] and I said, "And this is from when I went to Hawaii this summer, I went on a trip and Ms. Emily and I studied science," and I had my sea turtle. Well, the next thing you know, little girls, little boys, everything, "I have a sea turtle too!" I mean sea turtle beanie babies and everything. So now everybody is really into sea turtles. So I found some flip charts and then I added a little bit of our own stuff from Hawaii, cause when we were at that Marine Sanctuary they gave us so much stuff...we kind of tied it into a little creative writing...about sea turtles...And so, we talked about this book about sea turtles by Gail Gibbons...and we compared it to the baby honu's journey... (Interview with Sarah, October 7, 2011).

Sarah goes on to show examples of how she included Hawaiian games, sea turtle comparative anatomy, and many other fun exercises. She and her students even planned to adopt a sea turtle as part of her class's "action plan" for that year.

Although most teachers were able to include the ocean life in their classrooms, two teachers expressed frustration with their standards, which they feel are preventing them from teaching about fish. For example, Lisa said, "...I'm struggling to include the fish... the only

place I can think of to include it is just as a side anecdote or maybe when we're talking about the zones of the ocean...And that's about as far as we can go. We don't even get to classify fish or anything" (Interview with Lisa, September 7, 2011). Alissa shared in Lisa's frustration. When asked if an event of activity from Hawai'i stood out in her memory, Alissa said,

Oh yeah. By far it was the fish. I'm so jealous that Judy teaches oceanography because how can I implement fish into chemistry or forensics? I keep putting this around in my head how I'm going to do this, but it's still little nuggets of ideas at this point. But I loved that. I loved learning about the fish. I love being able to tell the difference between a Moorish Idol and a Pennant Tang. Like, I love that stuff. So, yeah if I can figure out a way to implement that... I don't know, but definitely I'm probably going to be teaching bio next year, so next year I can do the fish stuff [then] (Interview with Alissa, September 15, 2011).

Ocean Life as a Catalyst to Ocean Literacy

As expected, the beauty and grandeur of Hawai'i's coral reefs inspired tremendous awe in the Project ISLE participants. However, the effect that their experiences with the organisms had on their conceptualizations of ocean literacy was unexpected. In a sense, Hawai'i's fish acted as starting points for teachers' love for the ocean and served almost as teachers' tour guides for ocean appreciation and stewardship (OLEP&FC 5c, 5d, 6c, 6e, 6g). Once teachers had a love for Hawai'i's ocean life, they naturally wanted to understand and protect the reefs and other habitats. When asked to summarize what they learned in Hawai'i, several teachers responded with feelings of ocean stewardship. For example, Sarah said, "First and foremost, I found the need to teach about our delicate, wonderful ecosystems that exist in our world. From the amazing plant life...to the amazing marine animals and beauty of Maui, everything..." (Interview with Sarah, October 7, 2011). Emily agreed in her post-program survey and said,

I think the most valuable lesson I learned was the fact that we are depleting our oceans of all of their native wildlife by the millisecond. It truly saddened me after the course of the trip and just made me want to get involved, and especially want to start teaching my

students about ocean literacy so they too can become passionate about saving our planet (Emily, Post-program survey).

In her interview, Ashlyn attempted to explain how her experiences in the water helped her become more ocean literate: “Well I really didn't ‘care’ like I ‘care’ now about what takes place on the shores of our coast line. After actually swimming with sea turtles of all ages, you can tell how old the sea turtle is off hand by the size of the turtle...the turtles are so graceful and gentle...” (Interview with Ashlyn, October 6, 2011). Ashlyn went on to express concerns about fishing practices and habitat destruction that affect sea turtle populations, and how she has changed her behaviors as a result of her experiences. She summarized her new sentiments toward the ocean in her post-program survey as follows:

The oceans are our breath. They influence the weather the making of islands and the life it holds. Snorkeling, which I have never done before, made the ocean come to life for me. When we went to the beach to see a reef exposed due to the tides being low made me realize how much more life exists under coral and behind rocks and in and around seaweed that you would not otherwise see when snorkeling” (Ashlyn, Post-program survey).

Several teachers said that their appreciation for Hawai`i’s ocean life did not fully take hold until after they learned the fish’s species names. For example, Alissa said she had snorkeled with her husband in Hawai`i before, but knowing the names of the fish made all the difference for her: “You know that time when I went out snorkeling I was just looking. Oh that’s pretty. But this time it was, ‘What’s that?!’ Oh yeah, so by far that was my favorite” (Interview with Alissa, September 15, 2011). Amy also explained how knowing the fish’s “identity” helped her go from “just looking” to enthusiastic:

...the first time we went, I thought, ‘...there’s a little pretty blue fish, and there’s little pretty yellow fish.’ Whatever. And then we went through and had the classes and kind of drilled each other and have the other teachers talk to us about it. And then when I went back out, I think I was what the last person...to come out. It was so fun to actually

know what I was looking at...I had done that before, but I was kind of like...The last couple times I snorkeled, I went out and I saw the fish and I saw the coral and that was pretty and that was done. Like you know, I've seen everything. I didn't really know what I was looking at (Interview with Amy, September 8, 2011).

Lee also attempted to explain his new interest in fish in the form of an analogy:

Now I find that if you know what lives there—especially the bigger stuff—because usually the prettier stuff when it comes to the general public they go “Ooh” and “Aah” at the aquarium and then most people see and think, “Oh I want to protect this.” So it's kind of like seeing the little cute baby on TV and donating money to it. It's just kind of how the world works. So in terms of that, being able to identify fish definitely...came in handy (Interview with Lee, October 12, 2011).

Finally, Sarah explained how the ocean life helped her understand the importance of ocean stewardship and how she uses that relationship to foster ocean activism in her students:

... it's almost like ...a segue. If you can teach them about the reef animals and you can teach them about the whales and the dolphins and the sea turtles, and let them find that love for all those animals and then bring in the trash and say, “OK, now...look at the sea turtles, look at the sea urchins, look at this little crab, and now let's dump a whole four or five trash bags on top of that beautiful coral reef.”... And then it really hits home, and they're like, “OK, goodness. That's it.” You know, you as a six year old can make an impact on the ocean. And to teach them those things is...I think it reaches them, and they understand (Interview with Sarah, October 7, 2011).

Conclusion to Assertion Six: Ocean Life can serve as a Catalyst for Ocean Literacy

Appreciation and Development

In conclusion, so many teachers expressed a feeling of surprise at their enjoyment of the fish and ocean life while snorkeling. In fact, as described above, many teachers admitted that they did not think they would like snorkeling very much and that they would just have to “get through it.” However, those teachers were also the ones who were typically the last to get out of the water after each snorkeling experience. Also, although the middle and high school teachers really enjoyed the first snorkeling trip, they seemed to enjoy snorkeling much more upon hearing

a power point of the different fish species. After that, several teachers became almost competitive about which fish they saw and bragged about seeing certain rare species. For these teachers knowing the names of the fish helped them go from “just looking” to more of a scientific study, or as if they were being introduced to the fish, like they were “making a new friend” (See Louv, 2008, p. 41). The elementary teachers that expressed enthusiasm for ocean life were not quite as interested in individual species, but they had a tremendous appreciation for the experience as a whole. Many elementary teachers admitted that they were afraid or concerned about what would be in the water, and some of them even said that they did not think they could do it. However, when they actually did and saw how beautiful it was, they were so happy they conquered their fear and could not wait to do it again.

On the other hand, not all teachers were quite as enthusiastic about the fish throughout the entire trip. For example, Emily, Carly, and Marie did not seem nearly as interested and requested to lie out on the beach instead of snorkel. Despite her initial blog posting that raved of Hawai'i's ocean beauty Marie wrote in a later blog that she was, “Working on a positive aura (about living conditions) and fish identification today.” (Blog Post, Marie, June, 17, 2011). Later that day, Marie posted, “Beach and snorkel time! The water is very chilly, so (not surprisingly) the [XYZ Elementary] crew is lying out. Now this is Hawaii! (Blog Post, Marie, June 17, 2011). Marie also admitted later that she viewed fish identification as not challenging enough for her third grade students, and she did not think it was necessary to inspire ocean activism:

In the past, I've done the layers of ocean levels and stuff like that. I've taught different fish you would find in the different layers, and I think that's great for younger kids, but these kids, especially at [this school] in taking action and being IB students, it's really great to push them farther and show them that their behaviors affect the oceans and that there's something that we can do, even though we can't physically go every weekend to clean up the beach because we don't have it. But there are things that we can do here (Interview with Marie, September 15, 2011).

Similarly, Judy was not as impressed with Hawai'i's ocean life because she already had so much experience with it": ...well, I loved the fish component of it, but I knew a lot of that stuff already because my first job out of college was that ichthyology thing...I've seen tons of reef and fish, you know, to last me a lifetime" (Interview with Judy, September 15, 2011). However, other than these few cases, teachers felt a special bond with ocean life, and the memories of their experiences in the water will last them a lifetime.

Oceans are so vast and learning about them can seem daunting—as if teachers do not know where to begin. Based on teachers' reactions here and their usage in the classrooms, it seems as if the living things of the ocean area a good place to start. Teachers and students can relate to life and can appreciate the behaviors of organisms just going about their business and trying to survive. This is easier to comprehend than bigger ideas like sea floor spreading or thermohaline circulation. In other words, engulfing teachers and students in the ocean world through snorkeling or other means seems to help open teachers' eyes to the beauty and importance of the ocean. However, for many teachers and especially secondary teachers, they should go beyond "just looking." According to my data, in order to have ocean life really be a catalyst for ocean literacy development, many teachers also need at least a minimal understanding of the species name and natural history/behavior. That way they can go from "armchair spectator" to "participant." It is in feeling a part of the ocean world that really makes the experience special for teachers.

Assertion Seven: Teachers' Advocacy for the Ocean Increased as a Result of their New or Renewed Realization of the Global Implications of Human Actions

In addition to ocean life increasing teachers' appreciation and awareness of ocean literacy, other activities gave teachers a new or renewed appreciation for the global implications of human action on the oceans, which, teachers say, also increased their ocean literacy. This is the subject of the third assertion with regard to teachers' conceptualizations: How teachers' views about the human impact on the oceans changed as a result of their Project ISLE experiences and the effects teachers claim those changes are having on their personal lives and their classrooms (OLEP&FC 6c, 6g). During and after ISLE, teachers describe how their thoughts and feelings about the ocean-human relationship changed as a result of their experiences. In the following section, I detail the data collected that portray teachers' views before Project ISLE in their pre-program surveys and early field notes. Next, I describe the activities and speakers that teachers say are the most influential in helping them gain a new or renewed appreciation of these issues. Finally, I provide explanations and quotes from teachers' interviews that explain how teachers say those events impacted their personal beliefs, understandings, and feelings about the ocean-human relationship.

Teachers' Views of the Ocean-Human Relationship before Project ISLE

Prior to the Project ISLE program, most of the teacher participants did not speak extensively about their views concerning human impact, even though they viewed ocean science knowledge as important for students. When asked, "In your opinion, how important is it for students at your school to gain knowledge about the oceans?" Almost all teachers responded "very important," and several even said "extremely important." The reasons they provided for why they believe ocean knowledge to be important mostly centered on the fact that the oceans

take up so much of our world. In other words, they believed that since so much of the world is ocean water, and since it is the job of science teachers to educate students about the world around them, they would not be properly doing their jobs if they did not teach about the oceans. Some teachers, Emily, Virginia, Lisa, and Amy listed human impact as one of their reasons why ocean education is important. Also, the only teachers responses that came close to being negative cases were Lee and Ashlyn's who said, "I think it is important to have knowledge of everything that is around them including the ocean," implying that knowledge of the ocean is no more important than knowledge or any other scientific topic.

However, teachers' responses to this question conflicted somewhat with a later question, "What role does ocean science content education play in your classroom?" Many teachers who said teaching about the oceans was "extremely important" admitted in question five that they did not include many ocean topics in their classrooms due to pressures from high stakes testing. In other words, many of the teachers think ocean science is important for students to know, but they think it should be taught in someone else's classroom. The teachers who did not demonstrate these inconsistencies already had strong ocean units in place prior to Project ISLE such as the Earth Science teachers, or the teachers who do not face strong demands from high stakes testing such as the first grade teachers and the only administrator on the program. Of these teachers, two stood out as exceptionally aware of the "ocean connection" even before Project ISLE. For example, Lisa seemed to have a grasp of the global implications of human action on the oceans prior to ISLE. When asked how important it is for students at your school to gain knowledge about the oceans she said,

Oceans cover about 71% of our Earth. They are an important part of what makes life possible on Earth. Oceans are at the center of so many important processes on which we depend for survival. No matter how far away from the ocean one lives, oceans influences

daily life. From a human impact on our environment standpoint, it is important that student know/understand that they don't just impact their local geographical area. Everything thing they do will affect the oceans in some way. It's kind of the "think globally, act locally" attitude I try to develop (Pre-program survey, Lisa; OLEP&FC 1a, 4a, 6a, 6b, 6e, 6g).

Lisa later explained that in some sense, her entire curriculum is ocean literacy based and her students “never really leave it” no matter what they are discussing in Earth Science since the oceans are so strongly tied to all the other Earth systems. Virginia also had a firm grip of the importance of ocean literacy prior to her Project ISLE experience. When asked about her views on ocean education on her pre-program survey, Virginia described a lesson she already included and how she views environmental lessons as a gift to the students, instead of just a service to the Earth:

It is of extreme importance for the students to learn about our oceans. We must teach students to take responsibility for the Earth, and they must understand their impact! I have taught lessons, shown videos, and completed project based learning activities about the Great Garbage Patch swirling in the Pacific. Students are clearly shocked and troubled by their research. It is my hope that more lessons like these will make a lasting impression on the students and will encourage them to take action in their communities. Making informed choices about the products they use, the way they dispose of their waste, and sharing their knowledge with others can make a huge difference. Teaching students to be compassionate, productive, and informed citizens is one of the biggest gifts I can give them (Pre-program survey, Virginia; OLEP&FC 6e, 6g, 1c).

Virginia explained later in her survey:

As I mentioned, I place a great deal of emphasis on being responsible and intelligent citizens. Through this approach, ocean science education plays an important and relatively consistent role in our lessons. Whether we are studying Robert Ballard for his curiosity, the water cycle and weather, animal adaptations, Jacques Cousteau for his risk taking abilities, the connection between the unexplored areas of space and the ocean floor, or the Industrial Revolution and its effect on our air, water, and land, I feel that we always come back to the fact that water is extremely vital in our world (Pre-program survey, Virginia; OLEP&FC 6g, 7a, 7b, 1f, 5d, 3a, 2e, 6a, 6b).

Teachers' Development during Project ISLE

According to teachers' surveys and interviews, four key experiences during the program had a tremendous impact on teachers' views and beliefs about the ocean-human relationship, especially with regard to overlooked forms of pollution. First, June 11th was teachers' first full day of ocean literacy instruction, and it began with a lecture and beach hike with a native Hawaiian man who worked for the Department of Aquatic Resources, who called himself, "Uncle John." I described Uncle John's talk in my field notes as follows:

Uncle John mentioned that there is a stretch of beach where the currents converge carrying trash from all over the world. For example, he said they found a road sign or barrel of some sort that said "LAPD" on it. He also began talking about the Plastic Vortex in the Pacific, and how when big storms blow through there, a chunk of debris can break loose and wash up on this beach. Lisa expanded on this saying that it's twice the size of Texas...Emily seemed very disturbed by this and surprised that there was so much trash in the ocean" (Field Notes, June 11, 2011; OLEP&FC 1c, 6e, 6g).

Uncle John's talk led to a lively discussion over our picnic lunch about what teachers knew about the Great Pacific Garbage Patch how they confronted the issue in their classrooms. For example, Virginia said her fourth grade students did a problem based learning unit on the Garbage Patch and watched video clips on You Tube about it. Lisa said her students make "Public Service Announcements" about plastics in the ocean and marine debris that are aired on the school's closed circuit television system. She said, some students "come away from the experience swearing off plastic" and students want to know why no one is cleaning it up (Field Notes, June 11, 2011).

Secondly, teachers' awareness of the implications of marine debris was further heightened after a trip to the Humpback Whale National Marine Sanctuary where they watched a video about the conservationists' efforts to free Humpback Whales from fishing nets and other

debris items in which the mammals become entangled. Next, in addition to marine debris, teachers were surprised to learn about the effects of light pollution on nesting sea turtles and their hatchlings. In a lecture on the teachers' first night on Maui, teachers learned about sea turtle natural history and statistics with regard to population decline. Since baby sea turtles use the reflection of the moon off the water to find the ocean, they will often mistake streetlights or housing lights for the moon and crawl the opposite direction of the water where they cannot survive. Finally, on one of the last full days of the program, I gave the teachers a brief overview of the "basics" of ocean literacy in which I focused on the ways in which all people affect the ocean through the Earth's water system, such as with marine debris, overfishing, and eutrophication.

Teachers Describe a Change in Behavior as a result of Project ISLE

The activities described above affected teachers in a variety of ways, and many teachers explained in surveys and interviews that they have since changed certain behaviors at home as a result. For example, when asked about the influence people have on the oceans, Emily recalled the discussions of the Plastic Vortex in the Pacific, "The trash vortex had a huge impact on me and I believe it would impact more people if they were educated about it. It makes me think twice about grabbing another paper towel every time I'm in the kitchen" (Post-program survey, Emily). Similarly, Ashlyn's provided an example in response to this question, "...I used a straw or something and a little bit of the wrapper fell on the pavement, and all I could think of was the big police sign from LA washing ashore and how little things eventually make it into the water system. It doesn't matter...all the littlest things...so I picked it up" (Interview with Ashlyn, October 6, 2011). Additionally, Sarah described changes she has made in her classroom as a result of her experiences this summer, about which she says she is now adamant: "we're not

doing [group] snack this year...the parents would have a week and they would bring all this stuff from Costco and everything... [This year] they can bring little containers...and they all have to bring their own snack, and we're not buying all that massive bulk..." In her in-depth interview, Marie explained that her behaviors changed in both her personal and professional life:

I think I'm aware, and I've changed my habits since Hawaii. I mean, they've been relatively small, but I didn't even recycle before Hawaii and now I'm recycling. And I'm kind of a liberal recycler I think everything could be recycled...So I've began recycling, which is awesome...The kids are pretty good about recycling here because they do it at home, but now even more so this year I'm like: recycle it! Recycle it! So we're doing it here...and I'm more informed, so I'm informing my students more this year than ever before (Interview with Marie, September 15, 2011; OLEP&FC 6e, 6g).

Teachers' Desire to Share the Experiences with their Students

Throughout my post-program data sources, teachers almost unanimously say that they now have a strong desire to share their new knowledge about these human impact issues with their students to help them feel empowered for ocean stewardship. For example, when asked to describe her opinions about ocean literacy as a curricular topic in her post-program survey, Amy said,

I really want to make my students aware of the importance of our oceans to our survival. I want them to see the beauty and uniqueness of the oceans and the life it holds. I then want them to gain a respect for our ocean and realize that even though we don't live beside an ocean EVERY person has an impact on our ocean and I want them to have more positive effects than negative (Amy, Post-program survey; OLEP&FC 6a, 6b, 4a, 5c, 5d, 6e, 6g).

Emily said the most important thing she wanted her students to understand about the oceans was, "...the simple notion that all of the trash that they dispose of...it goes somewhere. It's not just...it doesn't just go away out of our minds. It's still on our planet on the Earth, and a lot of times, unfortunately, goes to the oceans (Interview with Emily, October 7, 2011; OLEP&FC 6e,

6g). Ashlyn had a similar response and described a desire to inspire awe in her students for the ocean:

I think I really would want the kids to have a great respect, reverence for the ocean. Not just respect, but almost...being in awe of it, so that they don't mistreat it. And then anything that lives in it is respected as well...And someone has to be steward of it...I mean, I'm so sensitive that anything endangered...I'm going to start applying feeling to the animals. And at the same token, if you don't respect it...um, they won't be there for other people to use. So...I want the children to gain such an immense respect for it (Interview with Ashlyn, October 6, 2011; OLEP&FC 6c, 6e, 6g).

Judy agreed with Emily and stated that thought the most important thing for her oceanography students to know would be: "What we do 250 miles from the nearest coastline has an effect on the ocean. You know, the plastics...Like, stop consuming plastics!" In her post-program survey, Judy recalled one description of how trash in the Pacific affects Hawai'i: "Hearing first hand from Uncle John tell the story of how a road barrier belonging to the Los Angeles Police Department was very memorable, and it just goes to show that a city thousands of miles away can pollute the island." When describing her opinions about ocean literacy as a curricular topic, Virginia explained that Project ISLE "strengthened her desire to pass the information on to the kids" and saw a connection between the global oceans and her school's International Baccalaureate initiative:

I definitely see the value in teaching ocean literacy as a curricular topic and find that it fits in seamlessly with the goals of the International Baccalaureate program. We need to foster a sense of responsibility, respect, and appreciation for our world, and we want students to explore their role as a member of society. Looking at oceans as one flowing and interconnected body that is essential to our Earth can help students make connections and personal choices that are both necessary and powerful (Virginia, Post-program survey).

In her oceanography course, Judy plans to include her experiences in the form of a bio-ethics unit in which students research various ocean environmental issues, present the information, and propose viable solutions, which the rest of the class would critique. On the

other hand, although she completely agrees with the other teachers' statements, Lisa's biggest concern is how difficult it is to help her rural, landlocked students to appreciate the ocean when many of them have never seen it:

I think what's important to me though, what always blows me away is the human impact on the ocean. I mean, yes it affects our lives and because we depend on it in so many ways, that we have to be really conscious of how we treat it. Whether we live in Kansas or California. So um it's a really hard concept to teach [landlocked] kids. Because to them even though they may be 2 or 300 miles away from the ocean, which is a doable distance, but many of them don't get outside of [our] county (Interview with Lisa, September 7, 2011; OLEP&FC 6e, 6g).

Conclusion to Assertion Seven: Teachers' Advocacy for the Ocean Increased as a Result of their New or Renewed Realization of the Global Implications of Human Actions

Several Project ISLE experiences came together to impact teachers' perception of humans in the world to leave a lasting effect on teachers. Some teachers who did not consider themselves to be environmentally conscious before the program (such as Marie) now cite ocean-friendly habits that they've adopted. Other teachers who were already pretty environmentally conscious walked away from ISLE with a renewed sense of purpose and an even stronger desire to protect ocean resources as a result of their experience. For example, Table 5.3 depicts a summary of teachers' responses to the second question on the post-program survey: "What do you consider to be the most important concept or concepts for students to understand about the ocean?"

Table 5.3

Responses to Interview Question “What do you consider to be the most important concept or concepts for students to understand about the ocean?”

	Conservation/Activism	Science focus
Name and justification as to why they feel that topic is most important	Lisa (plastics) Marie (one big ocean) Judy (plastics) Sarah (marine debris) Emily (marine debris) Ashlyn (endangered species) Virginia (no specific reason)	Amy (Impact all life) Alissa (70% of Earth) Lee (Impact all life)
Total	7	3

Most teachers cited conservation and ocean activism as the most important thing for students to know, and their reasons centered on the fact that our trash runs off into the oceans and stays there hundreds of years.

On the other hand, a change in heart with regard to the ocean environment was not evident in all teachers, such as Lee and Carly. Apart from Lee’s analogy described earlier in which he equated ocean stewardship to humanitarian efforts, neither he nor Carly mentioned any desire to protect ocean resources or share those feelings with his students. Also, despite their previous resolve, some teachers seem to view ocean advocacy as something to do “if there’s time.” Several teachers expressed sentiments of feeling “too overwhelmed” with the standards to include the level of ocean literacy and environmental activism they described in their post-program surveys. Supposedly, once the pressures of high stakes testing come on them combined with feelings of being overloaded, overworked, and overwhelmed, this environmental dedication lessens in terms of priorities. For example, Amy explained that she had put ocean literacy on the “back burner” in terms of importance. She explained in her interview, “...it’s really hard because you know there are certain things that I have to teach, and so I feel tied

to...teach the standards that they'll be "tested" on." She goes on to say later that it is easy to lose sight of those little things teachers are passionate about in the face of the day-to-day aspects of school life: "... I think because you just get so overwhelmed with the paperwork and the stress..." (Interview with Amy, September 8, 2011). Similarly, Emily admitted that she does not recycle if she is in a hurry or has a lot of other things going on.

Other than those examples, most teachers adamantly described the emotional ways that the four activities described earlier (Uncle John's talk, the marine sanctuary, the sea turtle natural history, and my ocean literacy explanation) affected their personal and professional lives. Interestingly enough, though, the total number of hours spent in those activities totaled less than four hours of the two-week period, and yet they struck a resounding chord with the teachers. This strong effect indicates how a little "gloom and doom" can go a long way toward ocean education.

Assertion Eight: The Hawaiian Islands can Serve as an Exemplary Model for the Teacher to Understand Ocean Literacy because it Provides a Context for Learning about the Ocean Human Connection and Cultural Heritage with Regard to the Ocean

Throughout the Project ISLE program, the teachers worked directly with numerous native Hawaiians and mainland citizens who had fully embraced the traditional Hawaiian culture and practices. By becoming embedded in the Native Hawaiian culture, teachers began to appreciate the traditional views of the islands, including the view of the oceans as a powerful force worthy of reverence and respect. This level of appreciation for the ocean seemed to help teachers understand ocean literacy by helping teachers see the ocean and its resources through the Native Hawaiian's eyes. In other words, the traditional Hawaiian culture embodies the essence of what

it means to be ocean literate and can serve as a model for other cultures. In the sections that follow, I describe the various cultural experiences that influenced the teachers so dramatically. I also explain teachers' reflections on the Native Hawaiian culture following these experiences and its impact on their personal lives and their desire to include learning experiences tied to the Hawaiian culture in their classrooms in an attempt to mimic their ISLE experiences and help students understand ocean literacy through the Native Hawaiian's eyes.

Teachers' Experiences with the Hawaiian Culture

Prior to the program, none of the teachers mentioned the Hawaiian culture in any of their pre-program surveys, application essays or field notes on the first day of the program, June 7th. However, after the first activity on June 8th, the Hawaiian culture remained a steadfast theme running throughout the remainder of my data. The first full day of the Project ISLE program began with a demonstration and lei-making instructions from a *Hula Halau*, or hula school. A Hula instructor came with three of her students to dispel any misconceptions the teachers may have about hula and its influence on the Hawaiian culture. For example, unlike what many tourists see, Hula is not just a dance, but an intricate ritual that recounts a Hawaiian legend or historical event. Also, leis are only made from natural substances and are worn on the head, both wrist, both ankle, and around the neck, each symbolizing a different form of connection to the Hawaiian people and the Earth. Their presentation was fully infused with environmental awareness and ecological literacy. For example, they believe that once Hawaiians are finished with a lei after Hula, they must then give the lei back to the Earth. "She said that it may seem frustrating that you worked so hard on the lei, and you don't get to keep it, but she said that's the way things go. You have to learn to let go of things. It's a lesson in life" (Field Notes, June 8, 2011). The instructor also emphasized the point that the lei placed on the head was to be

perfectly parallel to the Earth: "The parallel lei on the head is a symbol of humility: not higher than the earth and not lower than, but parallel to the earth. This whole process [of Hula] is a ceremony to show what Earth and life means to the Hawaiian people..."(Field Notes, June 8, 2011).

Teachers' responses to the presentation were powerful. Alissa eagerly recorded the Hawaiian words for the various terms used in the ceremony in her field journal depicted in Figure 5.18:

Figure 5.18:

Alissa, Field Journal Excerpt, June 8, 2011

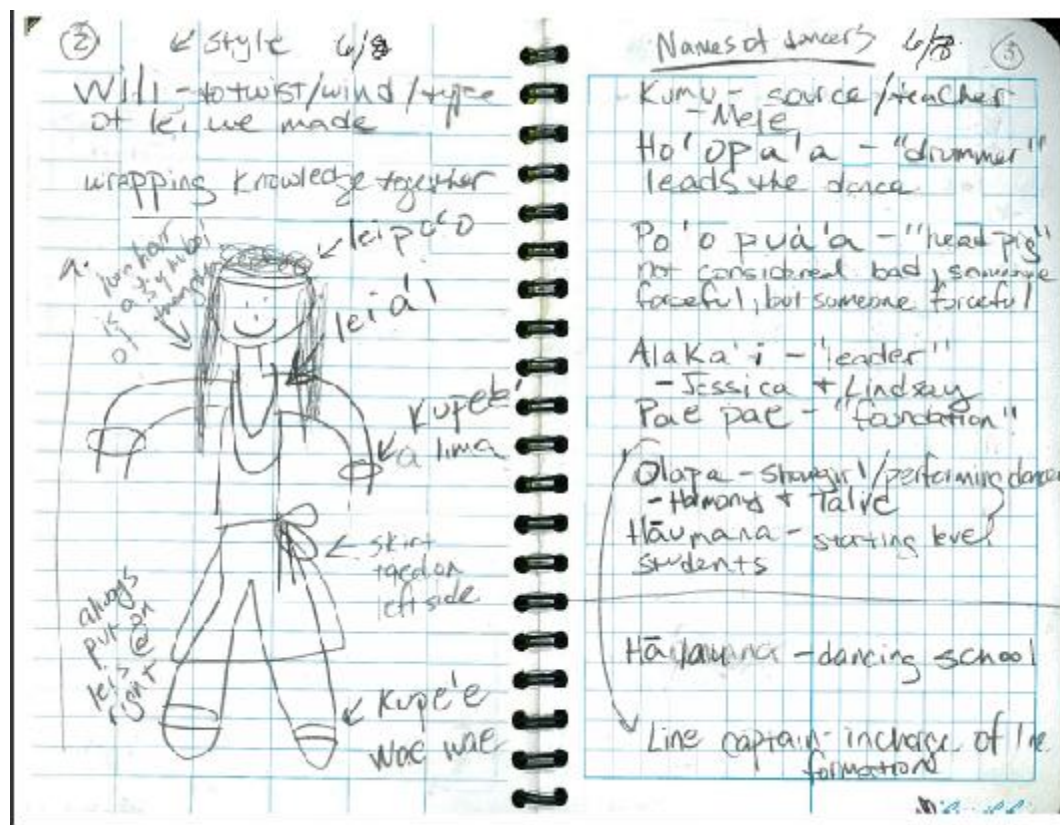


Figure 5.18: Alissa, Field Journal Excerpt, June 8, 2011

I also recorded a few of the teachers' reactions as well as my personal reflections in my field notes:

At the end, Alissa said, "That was beautiful," and Amy said, "I enjoyed everything." Personally, I enjoyed this presentation so much. I thought the hula demonstration was so meaningful. Their passion for the land and their culture was very moving and inspiring (Field Notes, June 8, 2011).

Emily recounted the experience in her field journal: "She came to talk to us about the meaning of Hula, [and it was] extremely moving... Carly was really moved because she just lost her father last December—it gives true meaning to why she is here, why we are all here."

Although this introductory experience with Hula seemed to be the most powerful among the teachers, other cultural experiences included paddling with traditional Hawaiian outrigger teams, providing offerings to the goddess Pele on a lava field, listening to Hawaiian introductory chants, and an explanation of the significance of traditional Hawaiian fishponds at the Humpback Whale National Marine Sanctuary. Throughout all of these experiences, and especially at the Marine Sanctuary, native Hawaiians and local enthusiasts explained their sense of responsibility to the land. One native Hawaiian described how previous generations were hesitant to "rock the boat" with the mainlanders, but this new generation feels the need to get back to their roots and resurrect their traditional culture. He explained how some native Hawaiians are angry at the destruction of the land and wish the mainland "*hales*" (white people) would leave. However, he believes that it is his responsibility to educate all of the people on the islands (native and foreign alike) to help them understand how to conserve the island's resources, protect the habitats, and preserve cultural traditions.

Teachers' Reflections on their Experiences with the Hawaiian Culture

By the end of the Project ISLE program, the participants were convinced that they had experienced the “true” Hawai`i that they would not have experienced if they had come here on vacation without the group. For example, Ashlyn explained that she believed she learned “the guts” of Hawai`i—everything inside and out, and she knows her experience was not typical of the average tourists:

A little girl when I was doing the leis yesterday said, “Oh we did this at the resort last spring when we went for spring break” ...And I said, who taught you? “Oh there was an...” We had an actual Hawaiian...we had actual women who spent their entire life growing up with this culture of the hula. And they're so dedicated to hula that they're like...She did not get the appreciation of [it all really]... I don't think I'd ever want to do Hawaii any other way now...then going to learn. How can you sit and lay on a beach and just not...It would be disgusting (Interview with Ashlyn, October 6, 2011).

Emily agreed with Ashlyn and said, “Hawaii is not just an island for lying on the beach. There are so many aspects of that island and the culture, and I think...the culture was huge for me...”

Sarah explained how she sees Hawai`i in a totally different light and wants to take her son there someday to experience all the things she experienced. Marie's final blog post sums up many of the teachers' sentiments:

Figure 5.19:

Marie, Project ISLE Reflections Blog, June 22, 2011

A Hui Kaua



Figure 5.19: Marie, Project ISLE Reflections Blog, June 22, 2011

My last day has come, and I'm missing Hawaii already. I've had such an amazing experience..As I sit in the Palm Beach of Maui, I feel somewhat sorry for those that venture to Hawaii merely for a beach. If the white sand beaches are what you yearn for, then the Pan Handle of Florida could suffice. To me, though, Hawaii has become so much more. She is a grand archipelago, 2,000 miles from any landmass that grew from the depths of the ocean to expose herself to the world, and pieces of her past are spread throughout the island for those that wish to know her better. Don't get me wrong, I don't think camping is the answer (although I did get a good education on native insect species), but I encourage you to explore more of Hawaii than the average person does as they sunbathe. Thank you Kilauea, Mauna Loa, Mauna Kea, Hilo, Kona, the honu, the humuhununu, kunukuaouaa, A'a, pahoehoe, lava tubes, Haleakala, the road to Hana, Paia, Lahina, Wailea and all the amazing people we met along the way. Hawaii, you've made me a better teacher, conservationist and person. A piece of my heart will always be with you. Aloha and Mahalo! ...A hui hou." [sic] (Blog Post, Marie, June 22, 2011).

Later in her interview, Marie described her emotional experience when writing this post and said she was sitting on the beach in front of the hotel where she had stayed for an extra day after the conclusion of the program: "it was just beautiful, gorgeous beaches, gorgeous hotel and it was picture perfect, and I was crying ... I had my sunglasses on and I was crying...and I was leaving

that afternoon. And my whole last blog is like, “If you go to Hawaii and you think that this is Hawaii—on the beach, on a surf board, or at these fabulous five star hotels, then like you’re missing the real thing” (Interview with Marie, September 15, 2011). Similarly, Virginia recalled a family friend’s enthusiasm for the Hawaiian culture prior to her departure in her interview. She said her friends make an effort to visit Hawai‘i during the hula competitions every year, and that they told her emphatically that she *had* to see the videos of the hula: “Well, I watched it and it was beautiful and I love dance, but now I realize why she was like, ‘No, you *must* sit down and watch this’... You know?” (Interview with Virginia, October 6, 2011).

Teachers’ Desire to Share Cultural Experiences

Upon returning to the mainland, many teachers found unique and meaningful ways to tie the Hawaiian culture into their scientific units and lessons. The elementary teachers gave a presentation at their school’s first faculty meeting of the year in which they instructed the other teachers in lei-making, gave them a chance to make their own leis, tasted taro yogurt, shared pictures, and described the importance and significance of the hula to the Hawaiian people. Ashlyn also shared the lei making with her second grade students. Before beginning the interview, Sarah showed me Hawaiian cultural coloring books that she used recently with her students and explained how her students learned to count to ten in Hawaiian while playing Hawaiian memory games. Similarly, in her post-program survey, Carly described how she expected the culture to affect her classroom: “I feel that I will give examples of how Hawaiians live and respect their land. When I teach the Native American unit I plan to bring in examples of how the Hawaiians had similar beliefs and respect of nature and their land.” Virginia also made a connection between the Hawaiian culture and the fourth grade curriculum involving the Native Americans: “And another connection that they made back to fourth grade was: the respect and

reverence for the Earth that we saw and that they also studied about Native Americans in fourth grade. And that same ...respect and ...just how it was so intertwined into who they were” (Interview with Virginia, October 6, 2011). As the curriculum coach for her school, Virginia shared a lot of her experiences with various groups of students around the school. As a result, many of the classes in 4th grade wrote Hawaiian myths, several 5th grade classes made “travel brochures” for the various Hawaiian islands, the music teacher taught 5th grade students a Hawaiian song with all the vocabulary terms from volcanoes, and they planned a fall celebratory luau for the whole school as the culminating activity. Several teachers also described their fascination with the Hawaiian language. For example, Lisa explained:

And one thing that intrigued me that I loved about Hawaii, I loved hearing the language and I loved hearing the different names. And one of the lessons I think that I sent to you, I talked about phases of the moon and eclipses. I wanted them to use the names for the sun, the moon, the earth, and the Hawaiian name of shadow, because that’s what they call an eclipse in Hawaiian. Getting them to label those things and just really internalize a lot of that learning so that it’s just a part of that. So they walk away with more than just a lesson (Interview with Lisa, September 7, 2011).

Judy explained that even high school students are curious about the Hawaiian culture and the language: “When I showed them the picture of the Halemaumau crater, they’re just like, ‘Why do Hawaiians have all these funky names?’ and I’m like, ‘Well, they only have 7 consonants...’ In her oceanography class, Judy also went into detail about Hawaiian history when they discussed native Polynesian voyaging and James Cook.

The Hawaiian Culture as a model for Ocean Literacy

Upon completion of the Project ISLE program, many of the teachers developed a deep sense of connection to Hawai`i and her resources as a result of the Hawaiian people. In her post-program survey, Carly explained that she believed the Hawaiian cultural experiences to be

among the most valuable ones she had learned: “I really enjoyed learning the about the legends of Pele and how nature is so important to the Hawaiian culture. Making the leis was meaningful in that Hawaiians are similar to the Native Americans in that they respect their land and they believe that what you take from nature should be given back to nature.” Marie described similar feelings in her interview saying that Hawai‘i, “is very different than here. You know, we’re just go, go, go, and don’t take a whole lot of time to reflect ... and they have such a different attitude towards life.” Ashlyn could also tell how the Hawaiian culture influenced the people’s views of the world around them: “But see the original Hawaiians, they really have respect for the water...And I was thinking...In order to live here, you’re really going to have to enjoy water.”

In her plan for an upcoming unit, Virginia explained that she wanted to teach “3rd, 4th, and 5th graders about respect, appreciation, and taking action as they relate to Hawaiian culture and the science lessons we learned there.” She went on to explain that the chants we heard on the islands help remind her to focus on the important things in life: “I loved learning about the chants, music, and other rituals that Hawaiians value. It was a nice reminder before canoeing and before and after class at the whale sanctuary that we must give thanks to those who have come before us and we must show respect for nature that surrounds us.” She later explained that Project ISLE, “gave me more of a broad view as to the importance of teaching Ocean Literacy. I now see many ways that I can successfully encourage students to make informed choices and change their behaviors through a study of science and culture.” However, the following response in Lisa’s post-program survey really seemed to summarize the importance of the oceans to the Hawaiian culture:

By looking specifically at [Hawaii], you can see how the ocean affects climate on different parts of each of the islands. You can see the water cycle at work and observe various habitats influenced by the oceans. I directly observed that Hawaiians acutely

understand their impact upon the oceans - they were particularly aware of and therefore careful of use and disposal of plastics. I also observed that Hawaiians recognized their dependence upon the waters surrounding their islands in terms of recreation, food, the trade winds moving across the ocean water, bringing rain.....Recycling seemed to be expected of every one there - whether a citizen or visitor. Living on an island has had a more forceful impact on their understanding (and therefore attitudes and behaviors) of human-ocean interrelatedness than that of a mainlander. However, we all need to realize that we essentially live on an island in space and that our resources are finite. They need to be managed accordingly. While nature can certainly reprocess and recycle, there is a limit. If we outstrip those limits, our future is bleak indeed (Post-program survey, Lisa; OLEP&FC 6c, 6e, 6g).

Conclusion to Assertion Eight: The Hawaiian Islands can Serve as an Exemplary Model for the Teacher to Understand Ocean Literacy because it Provides a Context for Learning about the Ocean Human Connection and Cultural Heritage with Regard to the Ocean

When teachers hear/see stories, explanations, and demonstrations about Native Hawaiians' experiences with the ocean and reverence toward it, it helps them appreciate the ocean on a personal level and see the ocean through the eyes of people who really respect it. This view helps to break down the western view of the ocean as a resource (or potential capital), and acted as a paradigm shifter for many teachers. Other island or traditionally coastal cultures with a similar reverence for the sea may also serve as an equally effective model for ocean literacy understanding.

I propose that a study of the Native Hawaiian culture in an ocean literacy program may help strengthen teachers' ocean literacy. Such culturally grounded pedagogy makes ocean literacy "real" to them by providing a context through which they can view the ocean. Additionally, culturally embedded curricula removes a lot of the "gloom and doom" out of environmental lessons while still getting the message across. Currently, Hawaiians are not all quite as conservation-focused as they once were, but there has been a resurgence in the Hawaiian

culture as of the past 20 years or so, which is why we saw so many great Native Hawaiian speakers that were so passionate about their world. However, not all of the Project ISLE teachers seemed as enthusiastic about the information presented in the native Hawaiian lectures. For example, none of Lee's responses in survey or interview questions reflected the reverence and appreciation that the other teachers' displayed. Still, the majority of teachers agreed with Ashlyn who explained how now that she had left Hawai'i, the Islands had "A mystical hold on you, and it has not ...Now I've been on several grant trips in the past ...[but] Hawaii has grabbed me, and I didn't think it would. I didn't think it would grab me like it has" (Interview with Ashlyn, October 6, 2011). Later, Ashlyn sent me an email with a quote she had found that seemed to sum up her and many of her teachers' feelings: "A Visitor touches Hawaii at great risk. He never knows when the passions of the islands will engulf him." (Email from Ashlyn, received October 14, 2011).

Summary of the Chapter

This chapter detailed the four main assertions that emerged concerning teachers' conceptualizations of ocean literacy. In one sense, teachers' conceptualizations are just as varied and expansive as their own personal experiences. On the other hand, several trends emerged from the data showing that Project ISLE impacted these unique teachers in similar ways as well. According to the data, the impact on teachers' conceptualizations of ocean literacy after Project ISLE can be summarized as follows:

1. Teachers' conceptualizations are highly variable and influenced strongly by their personal beliefs and classroom/grade level assignment.

2. Learning the names of living things in an area in which the teachers will be working helps “break the ice” for teachers’ ocean literacy learning and spark excitement not only to learn other aspects about the ocean, but also to protect marine resources, thus increasing their overall ocean literacy.
3. Exposing teachers to intensive in-depth examples of the reality of issues surrounding the ocean-human relationship opens teachers’ eyes to the need for ocean literacy in such a way that a movie, reading, or lecture never can.
4. Embedding ocean literacy instruction in pedagogy relevant to cultures steeped in “natural” or unforced reverence for the marine world is an effective way to help teachers change their worldviews about the ocean’s role in their lives and the impact their everyday choices have on the world around them.

Chapter 6

DISCUSSION AND IMPLICATIONS

Introduction

The purpose of this study was to understand teachers' conceptualizations and classroom inclusion of ocean literacy following Project ISLE: An intensive marine science professional development program. In conducting this study, it was my hope that I would be able to use the findings to add to, refine, or inform existing literature in professional development, environmental education, ocean literacy, and/or experiential education. Ultimately, I hope that my research will eventually support situations or instances in which additional teachers will benefit from high quality ocean literacy programs, bring their new knowledge back to their classrooms, and foster increased ocean stewardship in their students for the betterment of our ocean environments.

Review of the Chapters

Chapter One set the stage for the study by describing ocean literacy and introducing my research, including: the history of ocean literacy, why it is important for education, the need for pre-service and in-service teacher education in this area, the purpose of my study, its scope, and research questions/definitions. I described a wide variety of literature informing my study in Chapter Two, such as Socioscientific Issues, Situated Learning, Experiential Education, Professional Development, Teacher Beliefs, and Hawai'i as a context for the study. The

methods of the study are described in Chapter Three with detailed information on the Project ISLE grant, participant selection, program activities, data collection, and analysis. Chapter Four is the first of two findings chapters and describes teachers' classroom inclusion of ocean literacy in full lesson/unit form, anecdotal information (real-life stories), outside-the-classroom instruction, and improved teacher morale. The second findings section, Chapter Five, provides information and data regarding teachers' conceptualizations of ocean literacy, including the differences based on grade level, views concerning ocean life, increase in global perspectives, and influence of the Hawaiian culture. Finally, the purpose of this chapter is to review the most important information from the dissertation and how my findings relate back to the literature discussed in Chapter Two. I will also explain how my data add to, refine, or support existing data, and the potential implications for science education, professional development, ocean literacy, and other fields pertinent to the study. Finally, I conclude this chapter with a discussion of future research possibilities including how the program and study could have been improved, as well as a summary of lessons learned concerning this important topic.

Discussion and Implications

Assertion One: Teachers make Decisions to Include Ocean Literacy Lessons and Units based on their Personal Experiences and Teaching Contexts

The Project ISLE participants' inclusion of ocean literacy information in the form of full lessons and units from Hawai'i depended heavily on the teachers' personal backgrounds and grade levels taught. Elementary teachers tended to include ocean literacy lessons relatively consistently by working material into interdisciplinary units. I was able to observe two of the three middle-grades teachers, and they explained in interviews, emails, and conversations that

the majority of their ocean literacy inclusion came in the form of helpful stories or anecdotes mixed into pre-existing lessons. In other words, other than the sonar box demonstrations (see Assertion One), these teachers did not create entirely new lessons as a result of Project ISLE. Instead, they used their stories and pictures from Hawai`i in the lessons they already had in place. Finally, with the exception of Judy, who teaches an oceanography course, the high school teachers stated that they were only able to include one or two ocean literacy lessons in their classes due to the restrictions of their curricula or state standards.

Ties to the Literature. These findings support those of Klein and Riodan (2009), who studied teachers' usage of professional development materials. They found that, although all teachers received the same professional training, teachers fell on a "continuum of implementation," beginning with "No Implementation/Rejection," followed by "Token Implementation," "Mistaken Implementation," "Direct Implementation/Replication," "Adaptation Level I: Tinkering," "and Adaptation Level II: Crafting and Jiggering" (69-73), with most participants falling in the middle of the continuum and one refusing to implement it (No Implementation/Rejection). As described above, my participants fell on a similar continuum in terms of the level of their classroom implementation, with elementary teachers falling mostly in Adaptation Level I and with middle and high school teachers using Token Implementation. However, my data differ from Klein and Riodan's in that teachers were not expected to implement Project ISLE materials directly due to the high amount of content they received and the wide range of teaching levels of the participants. Similarly, the data also support the findings of Ernest's (1989) study, which indicated how two teachers might have similar factual knowledge but utilize this knowledge in the classroom in very different ways due to their beliefs.

Emily and Sarah both taught the same grade level and content, but their levels of Project ISLE ocean literacy classroom inclusion differed greatly.

Finally, the findings of the secondary teachers' hesitancy or inability to include their Project ISLE ocean literacy material correlates directly to Gillan (2011) and Stock's (2010) studies that describe the perceived barriers to ocean literacy inclusion. Stock explains that the teachers in her study identified obstacles ranging from "high stakes testing to lack of time, but not a perceived lack of importance" (p. 5). Similarly, Gillan's participants explained that they were not able to capitalize on materials from their marine education professional development programs because of a lack of ocean content in their state standards and core curricula as well as a lack of promotion for ocean literacy professional development within their school communities.

Potential Implications. The findings of this assertion have implications on professional development and ocean literacy bodies of research. First, it is unclear whether or not Klein and Riordan's study of professional development took teachers' grade levels into account when crafting their continuum of implementation. However, as a result of my analysis, my data suggest that separate continuums for elementary and secondary education would be helpful in illuminating teachers' inclusion. The curricula of the elementary and secondary education are so far removed from one another that separate continuums, combined with specific examples to account for interdisciplinary units or specific content at higher levels, may be helpful to understand how and why teachers approach professional development information. Additional research would be needed in order to formulate such continuums based on grade levels.

This assertion also echoes the specific need for ocean literacy professional development as cited in Cava et al., 2005. As the U.S. Commission on Ocean Policy (2004) pointed out, "School curricula, starting in kindergarten, should expose students to ocean issues, preparing the next generation of ocean scientists, managers, educators, and leaders through diverse educational opportunities," and teachers need to be prepared to facilitate this (p. 122). However, as discussed previously, a major barrier for teachers are their state standards, especially at the secondary level. Hoffman and Daniel (2007) offer insight into this issue and a possible solution:

Efforts to increase ocean-related education in the K-12 arena should not center entirely on improving or changing standards. While standards serve as a guide for teachers regarding the skills and knowledge they should teach their students, they do not specify exactly how a teacher should go about teaching. Teachers should thus be considered to be another key avenue through which ocean literacy education can be expanded. Teachers must be provided with the professional knowledge and skills, as well as curricular resources, to better integrate ocean literacy education into their teaching. Therefore, the ocean literacy and Earth system science education community should pursue a two-pronged approach that simultaneously focuses on revising state standards, when opportune, while simultaneously taking steps to making teachers aware of the importance of including ocean literacy principles (58).

The findings of this study support this claim and echo the need for increased ocean literacy professional development and classroom inclusion.

Assertion Two: Teachers' Use their "Real Life" Science Experiences to Enhance Ocean Literacy Curricula Inclusion

The Project ISLE participants valued their "real-life" ocean science experiences tremendously for a variety of reasons, and every teacher integrated their stories, pictures, etc. into their classrooms and curricula. Most teachers believed that embedding Project ISLE stories in their lessons (new or pre-existing) made their instruction more interesting and meaningful for the students. They also believed students would remember more if they heard stories or saw

pictures of their teacher interacting with the content they were learning firsthand. Teachers explained that they would not have been able to include as much ocean literacy in the form of stories and anecdotes had they read about Hawai'i in a book or taken a course at a college or university.

Ties to Literature. Similar to Project ISLE, Pop et al. (2010) also investigated “teachers’ motivation, expectations, and changes” following a summer professional development program known as Research Experiences for Teachers (RET). My research supports the findings of this study that also demonstrated the value of strong “real-life science” or research experiences for teachers. They explain, overall “...teachers were intrinsically motivated to participate in the RET program, were able to construct new knowledge through inquiry, and were able to apply the research experiences outcomes to their classroom teaching” (143). Additionally, as Shepardson, Harbor, Cooper and McDonald (2002) pointed out, when teachers are able to conduct environmental science research in a hands-on, engaging manner, their understandings of environmental concepts, issues, and pedagogical skills are positively affected. Klein and Riordan (2009) summarized their findings by saying that the higher the level of engagement teachers have in a professional development activity, the more they will adopt the topic of their experience in their own classrooms. Such authentic learning also supports the theory of Situated Learning. As Lave and Wenger demonstrate, situated learning focuses on authentic knowledge embedded within a context or culture.

Similarly, the Project ISLE participants also described the various ways in which their firsthand experiences helped them understand the scientific concepts and bring “real” science back to their classrooms. For example, the elementary teachers felt as if they gained increased confidence in science due to a better overall understanding of the science concepts. Secondary

teachers also felt increased confidence, but theirs was predominantly due to the authentic examples and stories that they felt enhanced their lessons. However, my data do not support Klein and Riordan's statement with respect to my high school participants. Even though they were highly engaged in hands-on learning experiences, most of them did not include significant amounts of the topic in their classrooms due to curricular restrictions.

Potential Implications. In order for ocean literacy professional development programs to have lasting effects on teachers, program leaders need to find ways to give teachers “real-life” access to the ocean. Teachers also value hearing from “real” experts, so if going to the ocean is not possible, maybe flying in charismatic speakers and scientists who do authentic work in the field would be more cost-effective. Additionally, teachers need to participate in authentic, inquiry-based ocean science; for example, they could visit a real marine laboratory, do behind-the-scenes work at a real aquarium, etc. Perhaps the speakers could conduct mini-experiments with the teachers. Whatever the inclusion, almost all the teachers in this study agree that seeing pictures, reading books, and looking at PowerPoint presentations about the ocean is extremely limiting for teachers' growth in terms of ocean literacy. If program coordinators want to have a lasting effect on teachers' beliefs, teachers need to fall in love with the ocean, want to protect it, and share this love with their students. Being there with the oceans is obviously the best option, but there are some possible steps leaders can take as a substitute.

The wealth of data supporting the benefits of situated learning for professional development programs is significant. All of the studies described in the above section demonstrate the need for teachers to be actively engaged in authentic situations that are natural to the field of study. Such “real world” experiences can foster significant changes in curricular instruction. However, as Garet et. al (2001) point out, most professional development programs

take the form of the “workshop,” or one-day-and-done, model that has limited time for teachers to process their new information or get deeply involved in research or authentic intellectual work. What’s more, professional development programs need to have a strong emphasis on both content and pedagogy in order to be the most effective. In other words, even if a program has strong authentic science activities for teachers, it will not have a significant impact on their curricula without a balance of pedagogical understandings, or a time for teachers to translate the content into lesson plans and units. Lasting two weeks in addition to experiences before and after the program, Project ISLE had significant extended contact with the teachers, all of which included a balance of both content and pedagogy. The fact that teachers are now including their authentic science experiences into their lessons on a regular basis in the form of full lesson plans/units, stories, pictures, and examples supports the research described above.

Assertion Three: Teachers’ Include Project ISLE Ocean Literacy Material Beyond their Individual Classrooms if Sufficient Administrative Support is Available

More than half of the Project ISLE participants spent hours, and sometimes days, preparing, presenting, and sharing their experiences and knowledge from Hawai`i with individuals outside of their own classroom. Such inclusion was an unexpected and welcome surprise for this study, and the impact of Project ISLE extended well beyond the groups of students they see on a daily basis. Teachers chose to share their experiences for a variety of reasons, including the requests of former students, their administration’s urging, or because of an individual purpose or goal, such as with the teachers’ blogs.

Ties to Literature. Based on the literature reviewed for this research, very few of the professional development programs studied the inclusion of program materials beyond the

participants' classrooms. However, the data supports the literature stating a possible reason behind the teachers' desire to do extracurricular inclusion: namely, strong program and school community support. For example, Garet et. al (2001) reported that teachers who attend professional development courses in teams from the same school tended to include more material than teachers who attend workshops alone. Garet et al. also described the benefits of having administrative leaders among the participants in professional development programs. Virginia's status as an administrator and her exceptionally high level of extracurricular inclusion of Project ISLE material support this research. Similarly, Roehrig, Kruse, and Kern's study sought to understand the implementation of reforms in chemistry curricula. They found that teachers' beliefs and community support had significant impacts. Based on the participants' administrations' response to the program, the teachers enjoyed a tremendous amount of support for their professional development in this program.

Potential Implications. Again, the teachers in this study enjoyed a tremendous amount of support from their peers and their administration with regard to their participation in Project ISLE. In fact, only one of the Project ISLE participants attended the program alone, Philip, and he was still able to include his experiences through local newspaper articles and multiple personally led workshop-style programs. Although Garet et al.'s (2001) study investigated teachers' inclusion in their classrooms, these data concerning Philip's classroom inclusion as an individual (not a part of a school team attending the program) may possibly add to or refine their work. Additional research would be necessary to understand whether there is a link between team attendance and extracurricular inclusion.

Additionally, due to the fact that all participants submitted letters of recommendation, they had a high level of support from at least one individual in their administrations. Many

teachers described support from their entire administrative teams. These data support Roehrig, Kruse, and Kern's (2007) findings concerning school community support. What's more, the teachers who described the least level of enthusiasm from their fellow teachers and administration (the high school teachers and Lisa/Amy) also displayed the least amount of extracurricular material inclusion. However, additional research would be needed to understand exactly how the various levels of administrative support influence the teaching of professional development program material beyond the classroom.

Several other questions remain unanswered with regard to this assertion. For example, it is unclear whether teachers would have had such a high level of extracurricular inclusion had the program taken place in a less exotic location, such as the coast of Florida. It is possible that teachers' greater school communities were naturally curious to learn about Hawai'i since it was such a long distance from the location of their school, and therefore more receptive to the participants' presentations. The participants' colleagues may not have been as interested in hearing about the Project ISLE experiences had the program taken place at an easily accessible destination. Additional research would be necessary to investigate whether programs like Project ISLE on the mainland have a similar effect on teachers' desire to share their knowledge beyond the classroom.

Assertion Four: Programs like Project ISLE can have Unintended Impacts on Participants' Classroom Inclusion, such as Increased Enthusiasm for Science Teaching

Another unexpected theme in the data was teachers' self-described sense of rejuvenation in their love of teaching and science following their experiences in Hawai'i. Half of the teachers (Alissa, Ashlyn, Sarah, Amy, Lisa, Virginia) specifically mentioned a feeling of refreshment

because of their participation. Prior to the program, they had felt burned-out or frustrated with teaching, but Project ISLE helped them to renew their passion for education or science teaching.

Ties to Literature. According to the literature reviewed in Chapter Two, Project ISLE could have had such a strong impact on teachers for a number of reasons. For example, Project ISLE meets the National Research Council's (1996) four main standards for teacher professional development: providing content through inquiry-based techniques; balancing of science knowledge, pedagogy, and the application of that knowledge; building upon teachers' existing understandings; and being coherent and integrated with other subjects and disciplines. (55-74). Teachers' improved morale could possibly have been accredited to the fact that the program was effective, as indicated by the fact that it met these standards, and thus supporting the research of the NRC. As Fraser-Abder and Leonhardt (1996) found, professional development opportunities can potentially impact both teachers' content knowledge as well as their levels of enthusiasm and self-assurance. Additionally, the extended, in-depth nature of Project ISLE could have helped improve teachers' morale. As Weiss, Banilower, McMahon, & Smith (2001) explain, the disconnected and decontextualized format of the one-and-done workshop typically does not match teachers' needs and is not as effective (Bransford, Brown, & Cocking, 2000; Wilson & Berne, 1999). It is logical to assume that the Project ISLE participants would not have enjoyed such feelings of revival had the program taken place in a one-day or one-weekend setting. Finally, Winther et al. (2002) found that teachers who initially enrolled in environmental education professional development simply for stipends or graduate credit persisted in teaching environmental education in their classrooms long after the course ended. In other words, this study demonstrates how some programs can have unexpected impressions on teachers, even when the teachers enroll in the programs for monetary or other nonprofessional reasons.

Similarly, Ashlyn explained that she signed up for Project ISLE simply because it was expected of her from her peers and administration, and she honestly did not really want to attend the program prior to departure. However, after the program, her descriptions of the influence of Project ISLE on her life surpassed that of any other participant, and she even went as far as to describe herself as “changed” because of the program.

Potential Implications. Based on teachers’ descriptions, a number of things came together to make Project ISLE special for the teachers that expressed their feelings of rejuvenation. These factors included: the exotic location; proximity to the ocean; intensive experiences with the ocean; ample opportunity to collaborate with peers; duration of the program; authentic and “eye-opening” experiences with science; and the high quality of instruction. It is unclear exactly how the combination of these factors impacted the teachers’ sense of rejuvenation or whether certain factors took precedence over others. However, due to the fact that teachers mentioned contact with ocean life and authentic science experiences significantly more than other features, it might be assumed that teachers believe these factors to be some of the strongest influences on their overall experiences. Therefore, if science education professional development programs would like teachers to experience similar sentiments, they should foster extended contact with natural settings and be situated in authentic scientific experiences that challenge teachers’ assumptions about science and/or human impact on the environment. Additionally, several teachers (Alissa, Amy, and Sarah) explained in conversations and surveys that they expected to have these feelings of revival. Therefore, it is possible that they had experienced these feelings before, following other programs. However, it is unclear exactly how the various qualities of a professional development program foster these particular sentiments. Additional research would be needed to understand exactly how location,

duration, collaboration with peers, team attendance, activity rigor, or other factors influence teachers' feelings of revival for education and whether one is more impactful than others.

Assertion Five: Teachers' Experiences and Assigned Grade Level Influence their Ocean Literacy Conceptualizations

Similar to Assertion One, teachers' backgrounds and grade levels influenced their conceptualizations of ocean literacy. In general, even though the teachers could recite the "official" definition of ocean literacy (i.e., "An understanding of the ocean's influence on you and your influence on the ocean" (National Geographic Society et al., 2005), their underlying beliefs about the topic, which I unearthed in their surveys, interviews, and casual discussions, did not always match up with the definitions. For example, elementary teachers tended to focus on the "literacy" side of ocean literacy and believed that if they were confident to read about ocean science concepts, then they were "ocean literate." On the other hand, high school teachers used "ocean literacy" and "oceanography" almost synonymously and tended to overlook the bigger picture of human impact implied in the official ocean literacy definition to focus on the scientific. The two middle grades teachers who completed the whole program were somewhat in between the other two groups of teachers and seemed to have a better grasp of the ocean-human relationship.

Ties to Literature. The data surrounding the findings of this assertion also support those of theories within teacher beliefs, professional development, and scientific literacy. First, my findings concerning teachers' conceptualizations of ocean literacy support numerous key studies within the body of evidence surrounding teacher beliefs. As discussed in Chapter Two, people form beliefs based on a lifetime of experiences that come together "to define a person's

epistemologic standpoints from which their beliefs, values and actions are derived” (Osborne, 1998, p. 428; see also Smith, 2005). The teachers’ personal lives and non-educational beliefs had a tremendous effect on their beliefs concerning ocean literacy, as was evident in their descriptions of memories and interaction with the ocean throughout their lives (Pajares, 1992). Similarly, Eraut (1985) and Goodman (1988) describe how individuals filter new information through “guiding images” or memories from their past before storing it cognitively or within belief systems. Therefore, it is no surprise that teachers with a stronger sense of ocean literacy (such as Sarah and Judy) tended to include more of it in their discussions and classroom inclusion. As Brown and Melear (2005) explain, when teachers’ belief constructs closely coincide with inquiry-based methods, for example, they will be more likely to include inquiry in their classrooms and model authentic science practices.

On the other hand, teachers’ resistance to altering their views about ocean literacy also supports the work of several studies. For example, as Pajares (1992) explains, beliefs established early in life tend to be stronger than those constructed more recently. For this reason, early experiences can have a stronger influence on teachers’ beliefs about teaching and learning than formal classroom experiences. (Smith, 2005, p. 26). One limiting factor in terms of altering teacher beliefs can be their views concerning their content areas (Klein & Riordan, 2009). Similarly, if teachers are hesitant in terms of their own self-efficacy in science, then they may become overwhelmed. Meichtry and Smith (2007) investigated teachers’ confidence, attitudes, and classroom practices as a result of a ‘place-based’ professional development experience and found that teachers’ confidence increased significantly. Although the elementary teachers in this study did express feelings of increased confidence after the program, they also felt overwhelmed with the amount of science information during Project ISLE, which supports the findings of

Fetters et al. (2002). These researchers attempted to understand elementary teachers' attitudes and dispositions following an inquiry-based professional development program. They found that teachers were resistant to change largely because the teachers expressed feelings of being overwhelmed with material and information, which led to anxiety about teaching inquiry. They conclude that in order to foster changes in elementary teachers' beliefs about inquiry, the teachers would require a highly supportive learning environment in which they have opportunities to be both student and teacher with a balance of content and pedagogical practice. Although Project ISLE participants did feel overwhelmed, they also included large amounts of ocean literacy into their classrooms. Not all of the ocean literacy lessons were inquiry-based, but their inclusion coupled with the fact that Project ISLE offered the highly supportive learning environment described by Fetters et al., supports their conclusions.

Potential Implications. Granted, this study is limited in its scope since the findings are the result of 12 teachers. Additional research would be necessary to support the claim that these findings are indicative of the majority of elementary, middle and high school teachers. However, if the data are indicative, it may be beneficial to tailor future ocean literacy professional development opportunities to address the needs and misconceptions of the three grade levels. For example, the high school teachers' resistance to view ocean literacy as separate from oceanography demonstrates a number of points within the scientific literacy bodies of knowledge. Fiske, Plankis and Marrero (2010) contend that individuals cannot be fully scientifically literate without also being ocean literate. Given this assumption, Bybee's (1997) description of scientific literacy falling on a continuum of development can be a helpful tool to assist secondary teachers with challenging their assumption that ocean literacy is synonymous with oceanography. For example, instead of viewing scientific literacy as a dichotomy between

literacy and illiteracy, Bybee argues that a continuum of development exists containing a series of “thresholds” that begin with scientific illiteracy, followed by nominal literacy, functional literacy, and ending with full “conceptual and procedural scientific and technologic literacy” (57-58). He argues that all learners, both children and adults, can be placed on the continuum at various points depending on their age, background, experiences, and scientific knowledge. Students move along the continuum as they complete additional scientific course work.

Ocean literacy can be viewed on a similar continuum, with the following thresholds: 1. Ocean Illiteracy, where students are unable to provide basic facts; 2. Basic Ocean Literacy, where students can describe basic facts about the ocean and its organisms; 3. One-sided Literacy, where students understand ocean science concepts but cannot explain how their lives are connected to the ocean; 4. Functional Literacy, where students have a sizeable knowledge of the ocean and interconnection, but act on this knowledge infrequently; and 5. Fully Applied Literacy, when students have highly developed ocean-interconnection knowledge put into action in the form of ocean stewardship, advocacy, or research. Figure 6.1 provides a graphic representation of this proposition:

Figure 6.1:

Ocean Literacy Continuum, with thresholds and threshold explanations

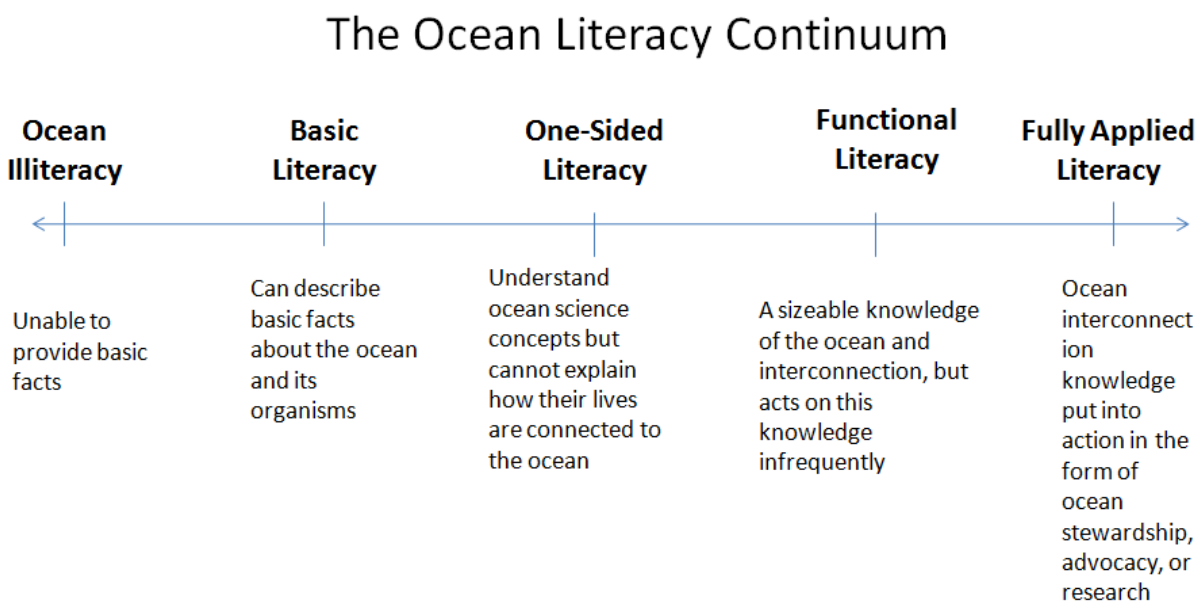


Figure 6.1: Ocean Literacy Continuum, with thresholds and threshold explanations

Several of the Project ISLE teachers described themselves as beginners in terms of ocean literacy, even though they often had extensive ocean science understandings. This suggests that some teachers view ocean literacy as unattainable because there is too much to know about the oceans to ever be fully literate. Such a mindset could potentially lead to nihilism—or the sentiment that there is too much to know, so why even try to attain ocean literacy? However, viewing ocean literacy as a process in which all people are developing may be slightly less threatening, so adopting such models in ocean literacy professional development settings could be helpful in breaking down those assumptions.

Other areas of potential future research surround the implications of teachers' content areas on their conceptualizations of ocean literacy. For example, the only middle-grades participants in Project ISLE were Earth Science teachers. It is unclear whether teachers of the other middle-grades science subjects, Life or Physical Science, might have approached ocean literacy in a similar fashion as Lisa and Amy. The high school participants taught Biology, Chemistry, Forensics, and Oceanography; had other disciplines been represented among the participants, such as Environmental Science teachers, they may have viewed ocean literacy differently.

Assertion Six: Ocean Life can serve as a Catalyst for Ocean Literacy Appreciation and Development

For almost all participants, teachers' deep sense of awe and appreciation for ocean life helped to foster a love for the oceans and desire to protect marine resources. Time and again, teachers explained how direct experience with ocean life through snorkeling, observing green sea turtles on the beach, and learning about endangered species conservation "made the ocean come to life" for the teachers and made them want to understand "the ocean's influence on [them] and [their] influence on the ocean" (Post-program survey, Ashlyn; National Geographic Society et al., 2006). These data support findings within environmental education, experiential education, and the professional preparation of teachers for environmental education.

For example, according to Hart and Nolan's (1999) meta-analysis of environmental education research, the ultimate goal of environmental education is to reconstruct society for the improvement of environmental behaviors and the protection of natural resources for future generations. As I described above, the environmentally focused activities and direct involvement

with the marine life increased participants' views of the importance of ocean stewardship and many also described altered behaviors as a result (See Assertion Seven below). What's more, as Seed (2008) demonstrated, environmental education professional development programs can take place in a variety of settings, but their impact increases dramatically when they take place outside of the traditional classroom where students are active participants in their learning. Such instruction describes Experiential Learning. When programs foster opportunities for "individuals [to] create knowledge through the transformation of their lived experiences" they force teachers to take responsibility of their knowledge development, thus leading to significant gains in understandings (Seed, 2008, 210). The Project ISLE participants' descriptions and reactions to the marine life support this theory.

Potential Implications. These data have tremendous implications for ocean literacy and the professional preparation of ocean literacy. Although these data came about as the result of only one study with 12 participants, their almost unanimous claims of the influence of direct experience with marine life on their views of ocean literacy are powerful. Therefore, ocean literacy educators need to find ways to foster similar direct experiences, no matter where the lesson takes place. Direct contact with ocean life in zoos and aquariums can also be meaningful, assuming the contact is extended and the programs place a strong emphasis on wildlife conservation. Also, teachers and students need to go beyond "just looking at the pretty fish" to interacting with the life forms through research or animal husbandry. As Louv (2008) explains, "Elaine Brooks...believed people are unlikely to value what they cannot name: 'One of my students told me that every time she learns the name of a plant, she feels as if she is meeting someone new. Giving a name to something is a way of knowing it'" (Louv, 2008, 41). My teachers expressed similar views.

Assertion Seven: Teachers' Advocacy for the Ocean Increased as a Result of their New or Renewed Realization of the Global Implications of Human Actions

Exposing teachers to intensive, in-depth examples of the reality of issues surrounding the ocean-human relationship opens teachers' eyes to the need for ocean literacy in such a way that a movie, reading, or lecture never can. Throughout Project ISLE, teachers took part in numerous activities that forced them to examine their implicit assumptions regarding human impact on the ocean. Experiences such as sea turtle conservation talks, beach walks with environmental engineers, and fish biodiversity assessments opened teachers' eyes to the global implications of human activity, regardless of proximity to the ocean. As a result, teachers said they walked away from Project ISLE with a new or renewed sense of purpose with regard to their personal environmental behaviors and ocean literacy education. However, despite their strong opinions at the end of the curriculum, teachers' assimilation of the material into their classrooms varied due to perceived constraints of standards.

Ties to Literature. The data supporting this assertion also corroborate research within the Socioscientific Issues (SSI) and environmental education professional development communities. First, the impact described above could be attributed to the fact that Project ISLE met the five criteria of high quality professional development in environmental education: (a) inquiry-based/challenge teachers to problem solve; (b) participatory in nature; (c) critical of educational values and assumptions; (d) involve teachers in real-world problems; and (e) encourage teachers to work collaboratively with one another (Fien & Rawling 1996). Perhaps such a program naturally fosters a global awareness of human action. For example, in Shepardson, Harbor, Cooper, and McDonald's (2002) work with watershed conservation professional development, they rationalized that the biggest impact on teachers was more of a

conceptual one: “perhaps the greatest change in teacher understanding was the shift to looking at watersheds as holistic and biological systems versus stream quality as associated with individual and isolated pollutants” (39). Project ISLE teachers also expressed a similar change: instead of viewing the ocean as a collection of systems, most teachers began to view the marine world as fragile and damaged as a result of human activity.

This research also supports the work of theorists within SSI. For example, in Sadler, Amirshokoohi, Kazempour, and Allspaw’s (2006) investigation of teachers’ perspectives of SSI and science instruction, they revealed five approaches that teachers take toward SSI: 1. Teachers who embrace SSI and include them in their classroom instruction regularly, 2. Teachers who want to teach SSI but believe they are unable to do so due to various constraints, 3. Teachers who did not like the idea of committing time to SSI instruction, 4. Teachers who did not believe values or ethics had a place in science education, and 5. Teachers who believed ethical development was a crucial aspect of all students’ education. The same five profiles could be used to describe teachers’ conceptualizations of ocean literacy. Teachers who enjoy more autonomy with respect to their curricula free of high-stakes testing (Sarah in first grade, Judy’s oceanography course, and Virginia’s administrative lessons) fell into the first category and embraced ocean literacy. On the other hand, most teachers fell into category two because they felt the pressures of high-stakes testing outweighed their desire to amalgamate ocean literacy into their classrooms, with some teachers seeming to fall in category three (Amy, Carly). Lee could possibly have fallen in the fourth profile because his responses on surveys and interviews were consistently science-focused and free of ethical perspectives. However, since he did not word his responses in exactly that manner, it is unclear whether he felt that ethical discussions about the ocean did not have a place in science education. Additionally, none of the teachers

specifically worded their responses to indicate that they felt ethical development was crucial to any child's development, but several teachers (Lisa, Amy, Sarah, Emily, Virginia) all indicated that they believed ocean literacy instruction to be essential to all students' educations.

Potential Implications. Clearly, the inclusion of environmental activities into ocean literacy programs is essential. However, as I discussed in Chapter Five, the amount of direct instruction with regard to human impact totaled only about four hours of the two-week period, but still had a tremendous impact. This supports the logical notion that a small amount of “gloom and doom” in education goes a long way, and too much can potentially lead to a sense of nihilism. However, additional research would be needed to understand exactly where the “gloom and doom” threshold resides, and when programs cross that line into fostering nihilism as opposed to empowering ocean stewards.

Additionally, the five profiles of SSI described above could be useful for future ocean literacy professional development. Perhaps program coordinators could create an instrument designed to place teachers in one of the five categories prior to the start of the program, so that they will be better able to meet their needs and challenge their assumptions about ocean literacy inclusion into their classrooms. The Ocean Literacy Network explicates that ocean literacy can and should be included in any science classroom, and the matrix in their “Essential Principles and Fundamental Concepts” pamphlet comparing the principles to the National Science Standards supports this claim. However, my teachers all received this information, and many still believed ocean literacy should be taught in another person's classroom. Perhaps identifying teachers' assumptions ahead of time would enable instructors to open teachers' eyes to possibilities within ocean literacy instruction more effectively.

Assertion Eight: The Hawaiian Islands can Serve as an Exemplary Model for the Teacher to Understand Ocean Literacy because it Provides a Context for Learning about the Ocean Human Connection and Cultural Heritage with Regard to the Ocean

In addition to exposure to marine life and eye-opening experiences, one other element of the Project ISLE program stood out as extremely influential on teachers' development of ocean literacy: the Hawaiian culture. Traditionally, the Hawaiian culture placed a strong emphasis on respect and reverence for all of the Hawaiian ecosystems, and especially the sea. Pacific Island theorists speculate that this view came about partially as a result of Hawai'i's location. With the nearest land being 3500 miles away, Hawai'i is recognized as the most isolated land mass in the world (Simon et al. 1984). Such isolation and such close contact with the ocean on a daily basis can have a tremendous effect on the lives and developing cultures of island settlers (D'Arcy, 2006). Although this deep reverence for the marine world has lessened in modern times, many native Hawaiians are striving to resurrect the beliefs of their ancestors within the Hawaiian populace. Throughout Project ISLE, teachers interacted with numerous native Hawaiians and enthusiastic mainlanders who fit this description. As a result, teachers began to see the ocean through the lens of the Hawaiian culture, which broke down some of their traditionally western assumptions about the ocean as a resource to be exploited.

Ties to Literature. These data elucidate the research behind "place-based" learning within environmental education. The theory behind "place-based" teaching is that if you know and understand the place in which you live, you are more likely to want to protect its resources, cultural history, and environment (Meichtry & Smith, 2007). Similarly, the North American Association for Environmental Educators (2004) explained the three goals of environmental education professional development as being: "a systems approach to education, the

interdependence between human and ecological systems and the importance of where one lives,” which aligns closely with that of place-based instruction (Meichtry & Smith, 2007, p. 16).

Although the participants were not permanent residents of Hawai`i, they still adopted many of the Hawaiian views toward the ocean as a result of the place-based instruction they received. Similarly, Meichtry and Smith (2007) studied the effects of a place-based program in which teachers traversed the headwaters of the Ohio River in order to increase teachers confidence in eight areas concerning inquiry-based learning and environmental education. They found that teachers’ confidence increased significantly, especially teachers’ confidence and ability to utilize community resources. Also, the authors noted that some intellectual gains were delayed until after the long-term post-test, or after they utilized the material in their classrooms. Similarly, the program assessments indicated that teachers’ classroom practice changed significantly in terms of the utilization of community resources, inclusion of field investigations, teaching of watershed topics, and the connection of real life to science. Teachers’ environmental attitudes also showed significant improvements in the post-assessments. Although the Project ISLE post-assessment was based on content knowledge and the Ocean Literacy Index (Marrero, 2010), the data collected through teacher observation and interviews support many of the findings in Meichtry and Smith’s study. For example, as described above, my participants expressed increased confidence in science instruction as well as an increase in their environmental awareness and stewardship. Also, since some teachers waited to include their Project ISLE material until the middle of the second semester (Emily, Amy, and Lisa), I also saw delayed results in terms of their perceived benefits of the inclusion of ocean literacy into their classrooms.

Potential Implications. These data suggest that ocean literacy instruction can benefit from culturally embedded or place-based curricula. Since we all impact the ocean through the Earth's water system regardless of our location on the planet, we are also all coastal dwellers, in a sense. However, since many cultures do not embrace the idea of the ocean as something to be revered, utilizing place-based instruction through the eyes of Native Hawaiians or other indigenous cultures could be beneficial in helping teachers view the ocean through their eyes and challenge their western assumptions. Additionally, several areas of future research exist within this assertion. For example, it is unclear whether other indigenous or Native American cultures would have the same effect on teachers' conceptualizations of ocean literacy as the Native Hawaiian culture did. Moreover, a longitudinal study of whether the effects of these views last would help to explain whether the effects of such place-based instruction are lasting, or whether teachers revert back to their western views once removed from the location in question. Similarly, it is unclear whether "other" place-based instruction would be effective if in two different locations. In other words, I am unsure whether ocean literacy program coordinators would be able to effectively lead a Hawaiian culture place-based program for teachers on the mainland with the same results.

Summary of the Chapter

The purpose of this study was to identify teachers' conceptualizations and classroom inclusion of ocean literacy following an intensive marine science professional development program. The findings of this study are meaningful to science education, professional development, environmental education, experiential education, and especially ocean literacy.

Implications for Future Research

In addition to the implications discussed in the assertion-literature analysis, copious opportunities for additional research exist concerning the topic of ocean literacy professional development. First of all, due to the fact that ocean literacy is a relatively new subject to the field of science education, these data are merely a drop in the bucket in terms of the potential for future research. Additionally, one question on the interview protocol did not shed light on any of the assertions, but it did provide some insight into potential changes to future professional development programs concerning ocean literacy. The Project ISLE participants expressed views concerning how the program could be altered to improve ocean literacy instruction. When asked, “If you were in charge of designing a professional development program for ocean literacy in Hawai`i, what would you do the same or differently in your plan as opposed to Project ISLE?” the participants answered this question either directly or used it as an opportunity to describe a desire of the program in general. For example, Lisa and Marie were the only two teachers to answer the question concerning ocean literacy specifically. Lisa explained how she felt her ocean literacy understandings would have benefited with increased time on boats out on the water, and Marie felt that an increased emphasis on ocean literacy from the start of the curriculum would have been helpful.

The other teachers answered this question with their general criticisms of the program. The three high school teachers all expressed a desire for the program to be tailored to high school teachers specifically. They felt frustrated with the occasional low level of science instruction and believed they would have learned more if the elementary teachers had not been there. However, it is doubtful that the high school teachers would have changed their level of

classroom inclusion even if the few “lower level” science activities had been removed. Still, additional research in this area would be necessary to clarify this issue.

On the other hand, two teachers stated they would have benefited from increased time devoted to pedagogical development. Virginia explained that she often felt overwhelmed by the amount of information in the program, and she also feels overwhelmed with an overload of schoolwork that she is now teaching. She explained that her classroom would have benefited from if the program coordinators had structured in additional time that would allow the teachers to get a unit “ready to go” for the students while they were still in Hawai`i. Similarly, Amy explained how she would have liked additional down time to expand her field notes in small groups with other teachers. Although Project ISLE instructors did make an attempt to include substantial amounts of pedagogical reflection and analysis time, it may not have been enough for some teachers. Additional research would be necessary to see if an increased focus on pedagogical content would have influenced teachers’ classroom inclusion of ocean literacy.

Lessons Learned: How the Eight Assertions of this Study Come Together

Four main lessons or big ideas stand out as a result of this study. First of all, Project ISLE impacted teachers in ways that were surprising to both the researcher and the teachers. For example, the teachers that felt the least “at home” in the outdoor settings in Hawai`i, or the ones who were pushed the farthest out of their comfort zones, seemed to gain the most from the experience personally, and these gains were reflected in the level of their classroom inclusion. Secondly, teachers’ backgrounds and grade levels are highly influential on their conceptualizations and classroom inclusion of ocean literacy. As with any topic concerning individuals, personal experiences and prior knowledge can have a tremendous impact. The data here are no exception, and the tendencies among the grade levels with respect to teachers’

conceptualizations and classroom inclusion of ocean literacy reflect this point. Third, although teachers know what the definition of ocean literacy is, their actions and discussions reflect a lack of a firm grasp on the topic. Finally, teachers see ocean literacy as important, but not as important as meeting their standards. As Nespor (1987) explained, beliefs about teaching are vulnerable to becoming confused with other beliefs that seemingly overlap with those typically held in education, and teachers may be unsure as to how to proceed because they are uncertain about the appropriate behavior for a circumstance. In this instance, teachers' beliefs concerning the high-stakes tests and the state standards take precedence over their new beliefs with regard to ocean literacy. The teachers who did not feel the pressures of high-stakes testing as significantly, such as first grade teachers, the administrator, and teachers of subjects that did not require an end-of-course test, tended to include more ocean literacy material from Project ISLE than others who felt limited by their standards.

The Potential of this Study and Future Studies in Ocean Literacy

Due to the new nature of ocean literacy as a topic within science education, this study is very meaningful to the field because it opens the door for discussions with regard to this important topic. As described in Chapter One, the oceans are largely ignored in classrooms across the country and the health of our oceans has continued to suffer as a result of such widespread ignorance. What's more, teachers do not really know what ocean literacy is, how to teach it, or even how to teach ocean science. Many see the oceans as vast and overwhelming, and they do not know where to begin with respect to fostering ocean stewardship. Therefore, some important aspects of this study are the implications that indicate multiple ways in which ocean literacy professional development can be strengthened in order to foster teacher growth in ocean literacy and increase classroom inclusion. However, the most important implication of

this study, and the critical capacity for future studies in ocean literacy, is the potential impact that increased knowledge can have on the betterment of marine habitats. The significance of such implications cannot be understated. As Roberts (2007) explained in his groundbreaking work, *The unnatural history of the sea*,

...we still have time to reinvent the way we ... protect life in the oceans. I am optimistic for the future. The creation of national and international networks of marine protected areas, together with some simple reforms in the way we fish, could reverse this run of misfortune. It will take concerted public pressure and political will to change attitudes that have become entrenched over hundreds of years. But if today's generations do not grasp this opportunity, tomorrow's may not get the chance because many of the species now in decline will have gone extinct (Roberts, 2007, xv).

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APPENDIX A

Ocean Literacy Essential Principles and Fundamental Concepts

Ocean Literacy Essential Principles	Fundamental Concepts
<p>Principle One: The Earth has one big ocean with many features.</p>	<p>a. The ocean is the dominant physical feature on our planet Earth—covering approximately 70% of the planet’s surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.</p> <p>b. An ocean basin’s size, shape and features (islands, trenches, mid-ocean ridges, rift valleys) vary due to the movement of Earth’s lithospheric plates. Earth’s highest peaks, deepest valleys and flattest vast plains are all in the ocean.</p> <p>c. Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of the Earth’s rotation (Coriolis effect), the Sun, and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation.</p> <p>d. Sea level is the average height of the ocean relative to the land, taking into account the differences caused by tides. Sea level changes as plate tectonics cause the volume of ocean basins and the height of the land to change. It changes as ice caps on land melt or grow. It also changes as sea water expands and contracts when ocean water warms and cools.</p> <p>e. Most of Earth’s water (97%) is in the ocean. Seawater has unique properties: it is saline, its freezing point is slightly lower than fresh water, its density is slightly higher, its electrical conductivity is much higher, and it is slightly basic. The salt in seawater comes from eroding land, volcanic emissions, reactions at the seafloor, and atmospheric deposition.</p> <p>f. The ocean is an integral part of the water cycle and is connected to all of the earth’s water reservoirs via evaporation and precipitation processes.</p> <p>g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments and pollutants from watersheds to estuaries and to the ocean.</p> <p>h. Although the ocean is large, it is finite and resources are limited.</p>

<p>Principle Two: The ocean and life in the ocean shape the features of the Earth.</p>	<p>a. Many earth materials and geochemical cycles originate in the ocean. Many of the sedimentary rocks now exposed on land were formed in the ocean. Ocean life laid down the vast volume of siliceous and carbonate rocks.</p> <p>b. Sea level changes over time have expanded and contracted continental shelves, created and destroyed inland seas, and shaped the surface of land.</p> <p>c. Erosion—the wearing away of rock, soil and other biotic and abiotic earth materials—occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.</p> <p>d. Sand consists of tiny bits of animals, plants, rocks and minerals. Most beach sand is eroded from land sources and carried to the coast by rivers, but sand is also eroded from coastal sources by surf. Sand is redistributed by waves and coastal currents seasonally.</p> <p>e. Tectonic activity, sea level changes, and force of waves influence the physical structure and landforms of the coast.</p>
<p>Principle Three: The ocean is a major influence on weather and climate.</p>	<p>a. The ocean controls weather and climate by dominating the Earth's energy, water and carbon systems.</p> <p>b. The ocean absorbs much of the solar radiation reaching Earth. The ocean loses heat by evaporation. This heat loss drives atmospheric circulation when, after it is released into the atmosphere as water vapor, it condenses and forms rain. Condensation of water evaporated from warm seas provides the energy for hurricanes and cyclones.</p> <p>c. The El Niño Southern Oscillation causes important changes in global weather patterns because it changes the way heat is released to the atmosphere in the Pacific.</p> <p>d. Most rain that falls on land originally evaporated from the tropical ocean.</p> <p>e. The ocean dominates the Earth's carbon cycle. Half the primary productivity on Earth takes place in the sunlit layers of the ocean and the ocean absorbs roughly half of all carbon dioxide added to the atmosphere.</p> <p>f. The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving heat, carbon and water.</p> <p>g. Changes in the ocean's circulation have produced large, abrupt changes in climate during the last 50,000 years.</p>
<p>Principle Four: The ocean makes Earth habitable.</p>	<p>a. Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean.</p> <p>b. The first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.</p>
<p>Principle Five: The ocean supports a great diversity of life and</p>	<p>a. Ocean life ranges in size from the smallest virus to the largest animal that has lived on Earth, the blue whale.</p> <p>b. Most life in the ocean exists as microbes. Microbes are the</p>

ecosystems.	<p>most important primary producers in the ocean. Not only are they the most abundant life form in the ocean, they have extremely fast growth rates and life cycles.</p> <p>c. Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.</p> <p>d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.</p> <p>e. The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.</p> <p>f. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is “patchy”. Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.</p> <p>g. There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms. Hydrothermal vents, submarine hot springs, methane cold seeps, and whale falls rely only on chemical energy and chemosynthetic organisms to support life.</p> <p>h. Tides, waves and predation cause vertical zonation patterns along the shore, influencing the distribution and diversity of organisms.</p> <p>i. Estuaries provide important and productive nursery areas for many marine and aquatic species.</p>
<p>Principle Six: The ocean and humans are inextricably interconnected.</p>	<p>a. The ocean affects every human life. It supplies freshwater (most rain comes from the ocean) and nearly all Earth’s oxygen. It moderates the Earth’s climate, influences our weather, and affects human health.</p> <p>b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation’s economy, serves as a highway for transportation of goods and people, and plays a role in national security.</p> <p>c. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures.</p> <p>d. Much of the world’s population lives in coastal areas.</p> <p>e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and</p>

Principle Seven:
The ocean is largely
unexplored.

activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

f. Coastal regions are susceptible to natural hazards (tsunamis, hurricanes, cyclones, sea level change, and storm surges).

g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

a. The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored. This is the great frontier for the next generation’s explorers and researchers, where they will find great opportunities for inquiry and investigation.

b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.

c. Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.

d. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

e. Use of mathematical models is now an essential part of ocean sciences. Models help us understand the complexity of the ocean and of its interaction with Earth’s climate. They process observations and help describe the interactions among systems.

f. Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, and physicists, and new ways of thinking.

APPENDIX B

PROJECT ISLE ITINERARY

Project ISLE June 7-21, 2010

Tuesday, June 7

- 1:00 – Arrive in Hilo Airport, take KMC shuttle to Volcano National Park.
- 2:30 -5:00 - Cabin assignments/unpack (Optional hike to the crater rim and steam vents. Leave from dorms at 3:30.)
- 5:00 – 6:00 – Course overview and start Hawaiian Island chain orientation
- 6:00 – 7:00 – Dinner in Volcano Village at Lava Rock Café (Bring around \$10).
- 7:00 – 8:00 –Continue Hawaiian Island orientation.
- 8:00 – Free time

Wednesday, June 8

- 7:00 – 8:00 - Breakfast in cafeteria.
- 8:00 - 9:00 – Course introduction, get lunches, and review daypack list.
- 9:00 – 12:00 – Introduction to Hawaiian plants and culture with Mele Uhrlich.
- 12:00 – 1:00 - Lunch in a “Hawaiian Hale”.
- 1:00 – 2:00 – Introductory Tour of Hawaiian Volcanoes Observatory with Janet Babb.
- 2:00 – 3:00 – Tour Jagger Museum and learn about eruption history.
- 3:00 – 3:30 – Travel to Visitor Center.
- 3:30 – 7:00 – Introduction to volcanoes with Donna O’Meara. (Meet at Visitor Center)
- 7:00 – 8:00 - Dinner in Volcano Village at Thai Thai. (Bring \$10 - \$25 for dinner)
- 8:00 – 8:30 – Time for reflection and sharing.

Thursday June 9

- 7:00 – 8:00 - Breakfast in cafeteria.
- 8:00 - 9:00 – Course Introduction, pack lunches, and review daypack list.
- 9:00 – 10:00 – Drive to Institute for Astronomy in Hilo.
- 10:00 – 11:30 – Introduction to IfA and Astronomy with Gary Fujihara.
- 11:30 – 2:30 – Self directed tour of `Imiloa and Lunch in Cafeteria. (Bring about \$10)
- 3:00 – 5:00 – Possible discussion of Polynesian Voyaging with Kalepa Eaybayan.
- 5:30 – 6:30 – Dinner in Hilo at Café Pesto. (Bring around \$10 - \$25)
- 7:00 – 8:00 – Return to KMC.
- 8:00 – 9:00 – Time for reflection and play.

Friday June 10

- 7:00 – 8:00 - Eat breakfast in cafeteria.
- 8:00 – 9:00 – Itinerary overview, go over daypack list. Get boxed lunch.
- 9:00 – 10:00 – Short native Hawaiian plant hike.
- 10:00 – 12:00 – Tour of Bird Park and Footprints trail.
- 12:00 – 1:00 - Lunch.
- 1:00 – 3:00 – Time for Lesson Sharing and Reflection.
- 3:00 – 5:00 – Hike Through Kilauea Iki.
- 5:00 – 6:00 – Early Dinner in Volcano.
- 6:00 – Thurston Lava Tube and possible interpretative ranger talk and lava viewing at Halema'uma'u.

Saturday June 11

- 7:00 – 8:00 - Eat breakfast in Cafeteria, and pack for the day.
- 8:00 – 9:00 – Drive to Punaluu Beach Park
- 9:00 – 12:00 – Learn about turtles and aquatic resource conservation with John Kahiapo. Time to enjoy the beach.
- 12:00 – 1:00 – More time to relax and eat lunch.
- 1:30 – 6:30 – An afternoon on the Kona side. Snorkeling in Kealahou Bay (the site of Captain Cook's Murder a great snorkeling spot; dolphins frequent the bay) Possible visit to The City of Refuge and shopping.
- 6:30 – 7:30 – Dinner in Kona. (Bring \$25-\$40 for dinner)
- 7:30 – Sunset – Kealahou Bay.
- 8:00 – Late – Return to KMC.

Sunday June 12

- 8:00 – 9:00 - Breakfast cafeteria.
- 9:00 – 12:00 – Time for relaxing, reflecting.
- 12:00 – 1:00 – Lunch.
- 1:30 – 3:30 – Lesson sharing and planning for next year.
- 3:30 – 5:30 – Hike through Footprints (Around 5 miles, intermediate)
- 6:30 – 8:00 – Dinner in Pahoa.

Monday June 13

- 7:00 – 8:00 - Eat breakfast in cafeteria.
- 8:00 - 8:45 - Itinerary overview and go over daypack list, get boxed lunch.
- 8:45 - 9:45 – Pack daypack, get ready for the day. Pick up vans from Harpers.
- 9:15 – 12:00 - Travel to the Mauna Kea Visitors' Center (Eat lunch en route)
- 12:00 - 1:00 - Adjust to altitude, safety orientation, and introduction lecture by observatory staff.
- 1:00 - 3:30 - Drive to the summit of Mauna Kea and tour the Gemini and Subaru Observatories.
- 3:30 - 5:30 - Optional hikes to glacial lake near the summit. Lesson on glacial geology.

- 5:30 - 8:00 – Drive back to Hale Pohaku for dinner. Those who can stand the cold can return to the summit to watch the sunset.
- 8:00 – ? – Stargazing with Steve O’Meara. Late night return.

Tuesday June 14

Early Group (Lindsay, Amy, Alissa, Judy, and Lee)

- 6:15 – 7:15 : Drive to Airport
- 7:15 – 7:45 – Drop off van, and check in for flight.
- 8:00 - Board flight.
- 8:24 – 9:01 – Fly to Maui
- 9:30 – 10:00 – Pick up Van
- 10:00 – 11:00 - Breakfast in Maui.
- 11:00 – 11:30 – Drive to Camp Olowalu, drop off luggage
- 12:15 – 12:30 –K-mart, pick up supplies
- 12:30 – 2:00 – Costco, buy food for Maui
- 2:00 – 2:30 – Non-bulk grocery store, buy food/supplies
- 2:30 - 3:00 – Return to Olowalu
- 3:00 – 4:30 – Set up camp
- 4:30 – 6:30 – Cook dinner

Late Group (Everyone else)

- 8:00 – 9:00 – Breakfast.
- 9:00 – 11:00 – Optional morning volcano education program at Volcano visitors’ center. Shop for teaching supplies.
- 12:00 – Head out to Hilo to eat lunch and drop offs (bring packed bags to van)
 - 3:00 – 5:30 – Fly to Maui
 - 5:30 – 6:00 – Seth and Len get vans, while group waits pulls baggage.
 - 6:00 – 6:30 – Drive to Olowalu

Together

- 6:30 – 7:30 – Dinner
- 7:30 – 9:00 - Cheryl King presentation on turtles, and dawn nest patrols.
- 9:00 – Free time

Wednesday June 15

- 6:30 – 7:00 – Breakfast at home base.
- 7:30 – 9:00 – Authentic Hawaiian outrigger paddle opportunity with the Kihei Paddle Club.
- 9:00 – 12:00 – Reef walk with Russell Sparks. Introduction to Project Wild.
- 12:00 – 1:00 –Lunch
- 1:00 – 3:00 – Visit Marine Sanctuary with Ka`au Abraham
- 3:00 – 5:00 – Time for reflection, Lesson Sharing and relaxation at the beach.

- 5:00 – 6:00 – Dinner in Kihei. (Bring \$10-\$20)
- 6:30 – 8:30 – Lecture about Hawaiian fish species and how to identify them. Guest Lecture Speaker – Marine Biologist, Donna Brown.

Thursday June 16

- 7:00 – 7:30 - Eat breakfast and pack lunch.
- 7:30 - 10:00 – Travel to the summit of Haleakala.
- 10:00 – 12:00 – Tour the Mees Solar Observatory.
- 12:00 – 1:00 – Eat lunch at the west Haleakala Crater trailhead.
- 1:00 – 4:00 – Hike the Haleakala Crater trail that travels several hundred feet down to the caldera floor where many volcanic features can be seen. (Due to trail difficulty, there will be an alternate trip planned to Hosmer Grove, a high altitude native bird sanctuary.)
- 5:30 – 7:00 - Dinner (or takeout) at Paia Fish Market. (Bring \$10-\$20 for dinner)
- 7:30 - 8:30 – Debrief and lesson sharing.

Friday June 17

- 7:30 – 8:00 - Eat breakfast.
- 8:00 – 8:30 – Tropical fishes of Hawaii lecture and daily itinerary with packing list.
- 8:30 - 9:00 – Pack lunches for the day.
- 9:30 – 12:00 – Ulua Beach, practice Fish ID in the water.
- 12:00 – 1:00 - Lunch
- 1:00 – 4:00 –Maui Ocean Center. Practice Fish ID.
- 4:00 – 5:00 – Time for reflection and relaxation at the beach.
- 5:30 – 6:30 – Dinner in Kihei (Bring \$10 - \$20 for dinner – multiple restaurants)

Saturday June 18

- 7:00 – 7:30 – Breakfast at home base.
- 8:00 – 8:30 – Expedition prep lecture.
- 8:30 – 9:00 – Pack lunches and gear bags.
- 8:30 – 10:30 – Dumps Beach (Moana Kala)- snorkel coral reef to view/identify Hawaiian tropical fish species.
- 10:30 – 12:00 – Cultural walk of La Parouse Bay (with Auntie Flo).
- 12:30 – 1:30 Lunch on the shore.
- 1:30 – 5:30 – Lesson sharing and time for reflection at Camp Olowalu.
- 6:00 – 7:00 – Dinner in Lahaina – depending on beach site. (Bring \$20-\$30)
- 7:00 – 9:00 – Enjoy Lahaina, possible shopping.

Sunday June 19

- 7:30 – 8:00 - Eat breakfast.
- 8:00- 8:30 – Orientation – Windward v. leeward island ecology in preparation for circumnavigating Haleakala by way of Hana.
- 8:30 – 9:00 – Pack lunch and bags.
- 9:00 – 7:30 - Travel around the east mountain of Maui. This trip famous route to Hana is a winding road through a dense tropical rainforest (got Dramamine?). There are plunging

waterfalls, botanical gardens, ancient Hawaiian sites and more. It is truly a trek back in time and through several types of biomes.

- 7:30 – 8:30 – Dinner at Paia Fish Market. (Bring \$15-\$25).

Monday June 20

- 8:30 – 9:00 - Eat breakfast.
- 9:00 – 1:00 – Drive, snorkeling, and lunch at Honolua Bay.
- 1:00 – 1:30 – Drive to Kahekili Beach.
- 1:30 – 5:00 – Bringing in back home. Start planning for how to integrate what you've learned into your class.
- 6:00 – 7:00 – Dinner (will vote).

Tuesday June 21

- 8:00 – 9:00 – Breakfast
- 9:00 – 11:30 – Packing for departure, goodbyes, and shuttles to the airport.
- (If staying on Maui, vehicles can be rented at airport.)

APPENDIX C
PROJECT ISLE APPLICATION FORM



Project I.S.L.E.: Integrated Science Learning Experiences

June 7-21, 2011, Hawaii

Project ISLE is a Teacher Quality Grant funded program designed for elementary teachers, administrators, and other educators who are committed to improving the quality of their science teaching. Workshop participants will spend one week studying Volcanology and Astronomy on The Big Island of Hawaii and one week studying Marine Ecology on Maui.

Participation in this course will earn applicants 10 Professional Learning Units (PLU's). Individual applications will be considered, but teams of teachers and administrators from the same school are preferred.

Please consider the following before applying:

- 1) **Cost:** Participants are responsible for their own airfare to and from Hawaii, approximately one meal per day, and snorkel gear (mask, fins, snorkel, and dive bag). Once on the islands, all lodging, travel, and activities are paid for by the Teacher Quality Grant (a \$3500/person value). Additionally, participants will receive a \$300 stipend upon completion of the course sequence to alleviate some travel expenses.
- 2) **Health:** Project ISLE is a rigorous outdoor experience, so applicants must be healthy enough to fully participate in all course activities. For example, participants will collect data while snorkeling in the ocean, go on a number of long hikes, and travel to high altitudes.
- 3) **Commitment:** Participants must agree to participate in the entire course sequence:
 - a. May 21: A preparatory meeting or orientation
 - b. June 7-21: The full two weeks in Hawaii
 - c. September 17 (approx.): Follow up meeting

*For more information, please contact Steve and Catherine Lindsay Linsky at
UGA.projectISLE@gmail.com*



Project I.S.L.E. Application
June 7-21, 2011

Name: Click here to enter text.
to enter text.

Phone: Click here
to enter text.

Mailing Address:

Email address:

Institutional Affiliation:

If this is a public school, what district?

Position:

Teachers: Grade(s) Taught

Subject(s):

Students: Degree sought

Major

Other:

- Do you expect to be working in the same capacity in the 2011-2012 school year?
If no, please explain
- Are you physically capable of participating in a wide variety of mildly strenuous outdoor activities?

Note: Each application requires a letter of recommendation and support from a supervisor (principal preferred.) Incomplete applications will not be considered. You are responsible for ensuring that all documents have been submitted.

Name of supervisor who will provide letter of recommendation/support

Email address of supervisor:

Essay: In 600 words or less, please describe your experience as a science educator and what you hope to gain from Project I.S.L.E.

Application Deadline: April 1, 2011

APPENDIX D

ORIENTATION AGENDA

Project ISLE Pre-Departure Meeting Agenda**Saturday May 21, 2011**

Leaders: Steve, Catherine Lindsay Linsky, and Seth

Location: _____ (Withheld for anonymity)

9:30—Teacher Arrival

As teachers arrive they will find their names tags with their given and corresponding “Hawaiian” names (according to: <http://hawaiiannames.hisurf.com/>) and sign in. Teachers will then have a few minutes to mingle and eat continental breakfast (donuts, juice, coffee). Meanwhile, we will loop a slideshow with pictures and homepage “screenshots” from the websites of the various locations we will visit with background Hawaiian music playing using the digital music library “Pandora.” At this time, we will begin taking pictures of the teachers individually with their name tags. We will compile the pictures into a handout, which will be emailed to all participants so that names can be learned quickly.

10:00—Introductions

To help teachers get to know one another better, we will begin the orientation by going around the room and introducing ourselves, starting with the course instructors. Each of the teachers will say their name, what grade they teach, their school and district, and one thing they are most looking forward to about going to Hawaii.

10:30—Course Agenda

Following introductions, we will distribute the full course agenda and then go through a PowerPoint of what to expect for the entire duration of their travels in Hawaii. We will introduce their learning experiences and explain logistical details such as their sleeping arrangements, transportation, etc.

11:00—Packing List and Important Documents

To help teachers prepare for departure, we will distribute a list of necessary items they will need on the islands. Special attention will be paid to items required for health and safety concerns like importance of strong sunscreen, water bottles, sturdy walking shoes, hats, etc. We will also distribute their snorkel safety vests, explain their purpose, and request that teachers include these in their luggage. They will return the vests upon completion of the program. Next, since several of the teachers mentioned that they have experience in courses such as this one, we will also open the floor for additional suggestions of useful or helpful items people could bring. Finally, we will distribute other necessary forms, emergency contact sheets, waivers, and medical information documents and allow for some time for teachers to complete this information. If possible, we will ask teachers to get that information back to us before they leave for the day.

11:30—Discussion of Course Assessment

The Project ISLE instructional team will then revisit an item on their agendas: the (almost) daily lesson sharing/brainstorming sessions. We will explain that due to the intensive nature of these learning experiences, significant time has been set aside for teachers to reflect on their learning and work together to brainstorm ideas for lessons and units. To help teachers in this process, each person will receive a bound notebook, which will serve as their field journals during the trip. We will expect teachers to use these to take notes, jot down lesson ideas, draw pictures/examples, and ask questions. Teachers will share their entries in small groups at these sessions to facilitate the brainstorming process. For the evaluation of the course, teachers will submit a unit of lessons they compiled from their learning experiences on the island. Also, prior to departure from Hawaii, teachers will hand in their field journals for evaluation. We will provide the rubrics for both the field journals and unit at this time of the orientation.

12:00—Break for lunch

12:30—Implementation of pre-assessment

At this time we will discuss the pre-assessment and the process of evaluation for Project ISLE mandated by the Teacher Quality Grant Program. We will also emphasize that this assessment will not be used to assign them a “grade” for the course, but will help us get a better understanding of course effectiveness.

1:00—Ocean Literacy Research

Before walking over to the Ramsey Center, Catherine Linsky will briefly describe her dissertation research on Experiential Professional Learning in an effort to recruit teachers for her study. As mandated by the Institutional Review Board, Catherine will be sure to emphasize that participation is completely voluntary, and their position in the program or course standing will not be affected should they choose not to participate. Additionally, identifying information will remain confidential, and teachers can choose to withdraw from the study at any time. Teachers will then receive consent forms and photo waivers for the study for review.

1:15—Transition to Ramsey

Finally, we will briefly introduce the purpose and goal of the snorkel safety check out, which is the final stage of our orientation. Teachers will then gather their belongings and walk a short distance to the Ramsey Athletic Center. There, they will head to the locker rooms and change into their swim attire and meet back at the diving well by the pool.

1:45—Introduction to Snorkeling

Ginny Barber, an elementary science teacher of gifted students and a 20 year SCUBA veteran, will assist the Project ISLE team in instructing the teachers about the basics of snorkeling, including how to use their safety vests, keeping their goggles clear, clearing water out of their snorkels, and shallow water free-diving for closer examination of specimen.

2:00—Teachers practice snorkeling with gear in pool.

2:30—Teachers change and report to a classroom in the Ramsey Center

2:45—Final Reminders

APPENDIX E
FIELD JOURNAL RUBRIC

Project ISLE 2011 : Field Journal Rubric

Teacher Name: _____

Grade Level Taught: _____

CATEGORY	Exemplary	Good	Satisfactory	Needs Improvement
"Data:" Notes and information from daily activities	Extremely detailed representation of material from every day's program activities	Detailed information from almost every day's program activities	Information from almost everything, but details are lacking	Info from several days missing and/or insufficient detail
"Imagery:" Drawings, charts, diagrams, sketches, rubbings, etc.	Several detailed diagrams that makes info easier to understand	Some diagrams are included and labeled	Diagrams are included but some seem disconnected to the material	No imagery OR very superficial
"Synthesis:" Summarize information, make connections between ideas	Thoughtful reflections each day. Consistently connected concepts in innovative ways	Summaries describes the information learned with some creative concept connections	Summaries describe the information learned.	No summaries is written.
"Evaluate/Create:" Brainstorm ideas for classroom, tie in standards, etc.	Many creative ideas for classroom inclusion cited. Clear evidence of lesson plan details forming	Several creative ideas for classroom inclusion cited. Evidence of lesson plan details forming	Some ideas for classroom inclusion. Little evidence of lesson plan details forming	No ideas for classroom inclusion discussed.

"Organization:" Is it easy to find information?	Table of Contents & Pages are: numbered, titled, and dated. Very easy to locate information quickly	Table of Contents & Pages are: numbered, titled, and dated. Notebook pages logically organized	Notebook pages logically organized	Information seems jumbled, unorganized. Difficult to find information
"Self Assessment:" Personal goals statement and end of course reflection	Thoughtful personal goals stated at beginning. Detailed analysis of learning/reflection of program at conclusion	Personal goals stated at beginning. Analysis of learning/reflection of program explained at conclusion	Goals and reflection presented superficially	Goals and/or reflection missing

APPENDIX F

UNIT RUBRIC

Project ISLE 2011 : Unit Rubric

Teacher Name: _____

Subject Taught: _____

Grade/School: _____

Standards required for classroom (Choose all that apply): GPS IB AP
EOCT

CATEGORY	Exemplary	Good	Satisfactory	Needs Improvement
Inclusion of Course Material	Highly innovative inclusion of program materials. Very effective transfer of info to the classroom	Innovative inclusion of program materials. Effective transfer of info to the classroom	Evidence of inclusion of program materials.	Program content inclusion confusing or inconsistent
Meaningful Learning Experiences	Unit reflects highly effective teaching strategies in a variety of lessons/activities	Unit reflects effective teaching strategies in a variety of lessons/activities	Unit reflects some effective teaching strategies with some a variety of lessons/activities	Teaching strategies ineffective or lesson formats are inappropriately repetitive
Logical sequence and organization	Lessons organized logically and very effectively	Lessons organized logically	Lessons organized well, but some room for improvement is evident	Lesson sequence confusing or ineffective

Standards	Lesson fits very well with multiple required standards. Aspects have potential to be in future lessons (not stand alone)	Lesson fits well with teacher's required standards and will make a nice addition to curriculum	Lesson fits well with standards, but seems to be "stand-alone" in nature.	Evidence of standard inclusion unclear or not evident
Differentiation	Unit provides effective educational opportunities for a wide variety of learners. Encourages higher order thinking	Unit provides educational opportunities for a variety of learners. Encourages higher order thinking	Unit provides educational opportunities for several types of learners.	Unit intended for one type of learner specifically
Introduction	Detailed unit intro that explains why you chose this lesson and what you want students to get out of it	Unit intro explains why you chose this lesson and what you want students to get out of it	Unit intro that explains why you chose this lesson and what you want students to get out of it, but details lacking	Unit intro that explains why you chose this lesson AND/OR what you want students to get out of it
Conclusion	Detailed conclusion with a clear explanation for how this lesson will lead into other topics	Detailed conclusion with an explanation for how this lesson will lead into other topics	Conclusion with an explanation for how this lesson will lead into other topics	Missing conclusion and/or connection to future topics
Format	3-5 lessons with all components: objectives, standards, background, materials, procedures, safety concerns, enrichment, and assessment	3-5 lessons with almost all components	3-5 lessons with objectives, materials, procedures, and assessment	Several important components missing and/or incomplete unit

APPENDIX G

LESSON SHARING EXPLANATION

Project ISLE Lesson Sharing Explanation

We are so excited that you will be joining us for Project ISLE: Integrated Science Learning Experiences. The purpose of Project ISLE is to strengthen your science content knowledge and your pedagogical skills in an experiential setting.

Rationale: The science content portion of the experience will be addressed in our daily activities, lectures, and outings. However, all teachers attending this program are successful and enthusiastic educators, so we would like each of you to share your pedagogical content knowledge with the group. These short “Lesson Sharing” sessions are designed to help inspire lesson plan ideas that include the material from Project ISLE.

Instructions: Please create a brief, 10-15 minute presentation that showcases one of your “best practices.” The mini-presentation should be something related to science that could be potentially altered for different age groups and conducive to the Project ISLE material.

Examples of possible “best practice” mini-lesson topics include:

- An explanation of a helpful website (such as trackstar, edu-blog, etc.)
- An example of an effective discussion format
- A role-play scenario
- An educational game (or game template)
- An explanation of a hands-on lab or activity (Note: Depending on the supplies required, a discussion of a hand-out is perfectly acceptable)
- An overview of an interdisciplinary unit that could include Project ISLE material
- A discussion of a “Problem Based” lesson
- Other: (You’re the experts!)

Handout: Please prepare a brief, 1-2 page explanation of your mini-presentation with any pertinent information the teachers would need to know in order to recreate it in their classrooms.

APPENDIX H

CONSENT FORM 1

June 7, 2011

Dear Educator,

You are invited to participate in a research study as part of an Ocean Literacy dissertation study. Your participation in this course makes you an ideal candidate for my research due to your status as an educator and your interest in marine science and science education. However, participation is voluntary. You can refuse to participate or stop taking part at any time without giving any reason, and without penalty or loss of benefits to which you are otherwise entitled. You can ask to have all of the information about you returned to you, removed from the research records, or destroyed.

The purpose of this research is to answer the following question:

What are the impacts on teachers' conceptualizations, and classroom inclusion of Ocean Literacy following Project ISLE, an experiential professional development program?

In other words, I wish to understand your conceptualizations of Ocean Literacy and whether this course will affect those understandings. The information generated may be used for academic presentations, research and/or publication, but all information will be kept confidential, and if you agree to participate in this study, pseudonyms will be used to protect your identity. Also, since the topic of Ocean Literacy is not a sensitive subject for most teachers, there are no reasonably foreseeable risks associated with your participation in this research. On the other hand, your participation will include the following benefits:

- a. You will have a chance to analyze and possibly re-think an important aspect of your curriculum that may or may not currently be present.
- b. Your input will provide the professors of this course meaningful feedback about the Ocean Literacy content of their course.
- c. Finally, after publishing your input and ideas, you will help other teachers see how they too can foster the next generations of ocean stewards in their classrooms.

If you volunteer to take part in this study, you may be asked to do one or more of the following things:

- 1) Complete surveys concerning my knowledge, perceptions and skills with respect to your experiences with the course and Ocean Literacy (15 minutes each)
- 2) Answer questions in an individual audio-taped interview concerning your beliefs, attitudes, and practice in relation to your experiences with the course and Ocean Literacy (20-40 minutes).

- 3) Allow the researcher to examine and analyze lesson plans and curricula materials that I write during the course.
- 4) Allow the researcher to examine and analyze the content and photographs of an optional travel blog of your experiences during Project ISLE.
- 5) Allow the researcher to examine and analyze the content of your application essay to the Project ISLE program.
- 6) Allow the researcher to observe your classroom during 2011-12 academic year. The researcher will take field notes of her observations.
- 7) You may be asked by the researcher to clarify information in a phone call or email, which may be subjected to analysis.
- 8) The researcher will document the professional development experience with photographs. Your image during course activities may be used in her dissertation work or in other professional settings.
- 9) The researcher may also ask to take photographs of your instructional materials that demonstrate your inclusion of the program material. However, student work or students images will never be photographed by the researcher.
- 10) The photographs you take of instructional materials you created as a result of this course (such as bulletin boards, example projects, etc.) may be analyzed and reproduced to support this research. If requested, photographs taken by you will be credited if published.

All participants in this study will be asked to answer survey questions about their understanding of Ocean Literacy before and after participation in the course. Each survey should take you approximately 10-20 minutes to complete. If further clarification of survey information is needed, you may be asked to participate in a very brief, audio-recorded interview (20-40 minutes). Please note that any audio recordings will be destroyed after two years, and all individually identifiable information will be kept confidential. I will also observe you and the other teachers during our class activities and record notes in a field journal about your reactions, comments, and any other pertinent information observed. Lastly, you may be invited to participate in observations of your classroom inclusion of the professional development materials. The researcher will observe classes that you teach during visits to your school setting and take field notes of her observations (*approximately 3 hours*).

****Please indicate below what uses of photographs that you agree to:**

Photos can be used at meetings of researchers. Yes_____ No_____ [Please use initials]

Photos can be used in classrooms for students. Yes _____ No_____ [Please use initials]

Photos can be used in publications. Yes _____ No_____ [Please use initials]

Photos can be used on an educational blog. Yes _____ No_____ [Please use initials]

Again, your participation is voluntary, so should you choose not to participate, your decision will not have an effect on your class standing, grade, PLU status, etc. You are free to withdraw your participation at any time should you think it necessary. Also, if you have any questions or concerns, feel free to contact me at 404-731-4757 or at clinsky@uga.edu. I hope you will enjoy this opportunity to share your experiences and viewpoints with us. Thank you very much for your help.

Sincerely,

Catherine Lindsay Linsky
Doctoral Student, Department of Math and Science Education
University of Georgia
clinsky@uga.edu

Advisor:
Dr. Seth
Department of Math and Science Education

Signature of Participant

Date

Signature of Researcher

Date

Please sign two copies, keep one copy and return one to the researcher.

APPENDIX I
PRE-ASSESSMENT

Name: _____

Project ISLE: Content Knowledge Pre-Assessment

The purpose of this assessment is to evaluate the effectiveness of the Project ISLE program. You will receive a post-assessment at the end of the program to see how your conceptualizations developed, but the results will not be used to assign a grade to you, personally. This assessment not only examines your knowledge of the concepts we will address on Hawaii, but since some of our program addresses non-cognitive traits, we also have a few questions designed to assess your attitudes, behaviors, and exposure to some of our Project ISLE topics. Please answer to the best of your ability.

Part One: Content Knowledge

1) A star's color provides information about its:

- a) Size
- b) Distance from the Earth
- c) Chemical Makeup
- d) Temperature

2) Which of the following types of volcanoes make up the Hawaiian Islands?

- a) Flood (or Plateau)
- b) Shield
- c) Composite
- d) Cindercone

3) Which of these is true about erosion?

- a) erosion only happens quickly
- b) erosion only happens to rocks
- c) erosion only happens slowly
- d) erosion can happen quickly or slowly

- 4) Certain areas of Hawaii have black sand beaches because of:
- a) indigenous congregations of black-shelled oysters
 - b) splatter where lava hits ocean water
 - c) erosion from volcanic rocks
 - d) wild fires that are common in those areas
- 5) Which types of living things are there the most of in the ocean?
- a) fish
 - b) plankton
 - c) animals with shells
 - d) whales and seals
- 6) In which of these places would you find the most ocean life?
- a) every part of the ocean has the same amount of life
 - b) warm waters near the equator has the most life
 - c) the middle of the ocean far from land has the most life
 - d) cold waters near the coast has the most life
- 7) Which of the following represents a problem that threatens an unusually large number of Hawaii's marine and terrestrial species?
- a) Agricultural runoff.
 - b) Hydrocarbon pollution
 - c) Hunting and fishing
 - d) Introduced species
- 8) Which of these reproductive strategies do parrotfish use?
- a) Females can turn into males.
 - b) Males care for the young.
 - c) They build nests in coral reefs.
 - d) They form mating pairs.
- 9) In the last several decades, the environment around the Puna District of the Big Island has been dramatically changed as a result of
- a) human development.

- b) a hurricane.
- c) coastal erosion.
- d) a volcanic eruption.

10) It is likely that the fish pictured below eats:

- a) Plankton
- b) Other fish
- c) Algae
- d) Coral



11) The fish below is a:

- a) Golden Eyed Surgeonfish
- b) Golden Eyed Butterflyfish
- c) Golden Eyed Angelfish
- d) Golden Eyed Sunfish



- 12) The lateral line in a fish
- a) is used to signal other fish.
 - b) is a sensory organ.
 - c) helps the fish move through the water.
 - d) runs ventrally along the fish's body.
- 13) Techtronic activity affects the ocean in the following ways:
- a) by providing the ocean with chemicals
 - b) influencing the ocean's shape
 - c) influencing oceanic heat distribution
 - d) all of the above
- 14) The deep valleys found on the windward sides of the Hawaiian Islands are formed mainly by:
- a) Volcanic activity.
 - b) earth quakes.
 - c) erosion.
 - d) the impact of organisms.
- 15) Coral live in a very close symbiosis with
- a) Zooxanthellae
 - b) Polyps

- c) Cnidaria
- d) Nematocysts

16) The most important way to respond to threats to Green Sea turtles (aka Honu) is

- a) to protect the coral reefs.
- b) to protect their nests.
- c) to protect their food supply.
- d) to protect their migration routes.

17) The largest volcano in the solar system is on

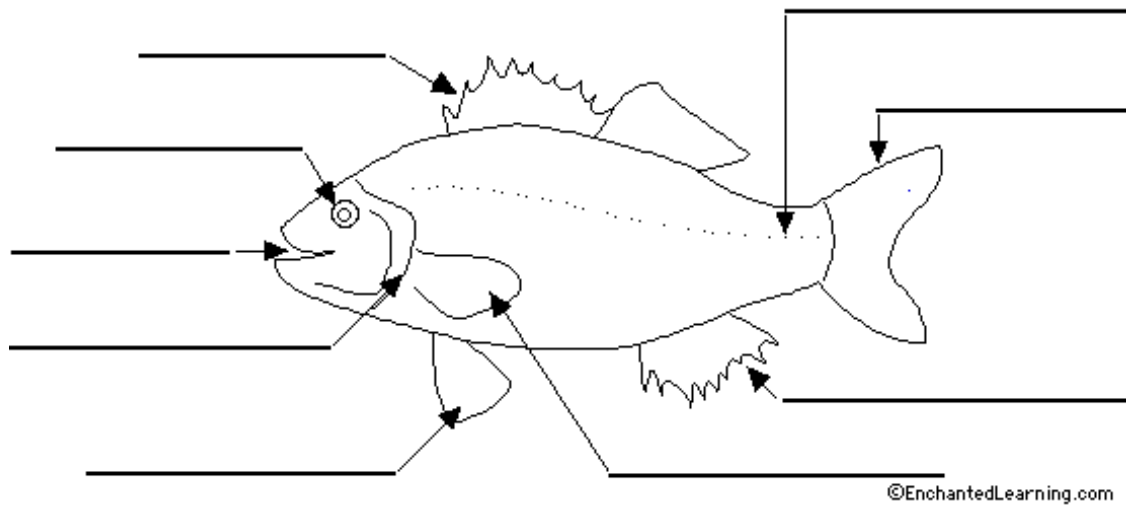
- a) The earth.
- b) Venus.
- c) Mars.
- d) Jupiter.

18) The decision to reclassify the object formerly known as the planet Pluto was made because of new information about

- a) Kuiper belt objects.
- b) extra-solar planets.
- c) the Oort cloud.
- d) Pluto.

19) Label the parts of the drawing below:

Mouth, eye, operculum, anal fin, caudal fin, dorsal fin, pectoral fin, pelvic fin, lateral line.



20) Which science disciplines factor in to the study of oceanography?

- a) chemistry
- b) biology
- c) physics
- d) all of the above

Part Two: Beliefs, Behavior, and Exposure

21) *(To what degree do you agree with the statement?)*

“I feel comfortable in outdoor, natural settings.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

22) *(To what degree do you agree with the statement?)*

“Each of us has a personal responsibility to protect the ocean”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

23) *(To what degree do you agree with the statement?)*

“I have no effect on the oceans since I live so far from them.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

24) *(To what degree do you agree with the statement?)*

“I contribute to the problems facing the ocean.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

25) *(To what degree do you agree with the statement?)*

“I feel a sense of amazement and appreciation for ocean life.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

26) (How often do you...)Make an effort to conserve water in your daily life?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

27) (How often do you...)Recycle paper, plastics, glass, and other materials

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

28) (How often do you...) Pick up litter?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

29) (How often do you...) Avoid buying seafood that is overfished or caught/farmed in ways that harm the ocean?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

30) (*To what degree do you agree with the statement?*)

“I would support efforts to protect the marine environment, even if it meant paying more for seafood or closing certain beaches to the public.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

31) How often have you visited the ocean/coastline this past year?

- a) None
- b) Once
- c) Two or three times
- d) 4-9 times
- e) About once a month or more

32) How often have you visited an aquarium in the past year?

- a) None
- b) Once
- c) Two or three times
- d) 4-9 times
- e) About once a month or more

33) *(To what degree do you agree with the statement?)*

I visited the ocean often as a child

- a) Strongly disagree
- b) Disagree
- c) No opinion
- d) Agree
- e) Strongly agree

34) *(To what degree do you agree with the statement?)*

I like to read or watch TV programs/movies about the natural world

- a) Strongly disagree
- b) Disagree
- c) No opinion
- d) Agree
- e) Strongly agree

35) *(To what degree do you agree with the statement?)*

I visited zoos or aquariums often as a child.

- a) Strongly disagree
- b) Disagree
- c) No opinion
- d) Agree
- e) Strongly agree

APPENDIX J

PRE-SURVEY QUESTIONS

Pre-Course Ocean Literacy Survey***Personal Information*****1. Contact**

(Remember: All information will be kept strictly confidential, and all identifying information will be deleted from any reports or publications.)

Name: _____ Email: _____

Grade Level: _____ Subject: _____

School: _____

Title: _____

2. What grade level(s) do you teach? _____

3. What subject(s) do you teach in a typical week? _____

4. As of this year, how many years of teaching experience have you acquired?

Teaching Experience: _____ Years

5. Please describe your educational background. What degrees do you currently hold? In what areas are you certified?

6. What disciplines do you teach in a typical week? With your answers, please include an estimated percentage of instructional time spent on each subject/discipline.

- ☐ Math: _____%
- ☐ Science: _____%
- ☐ Social Studies/History: _____%
- ☐ Language Arts/English/Reading: _____%
- ☐ Connections Courses: _____%

Specific Course Title(s):

Project ISLE Ocean Education Questions

Please answer these questions honestly and with as much detail as possible. Remember, all information will be kept confidential.

1. What drew you to this professional development experience?
2. How do you expect your experience in this course to impact your teaching?
3. In your opinion, how important is it for students at your school to gain knowledge about the oceans? Please explain.
4. How do you define “Ocean Literacy?”
5. What role does ocean science content education play in your classroom?
6. In a typical school year, approximately how many of your classroom lessons include the following topics?

a. Properties of ocean water:

Ex: Ocean water properties such as salinity or saltiness

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

b. The ocean’s geographic features:

Ex: Names of the oceans, connections between oceans

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

c. Movement of water in the ocean:_____

Ex: Tides, currents

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

d. The ocean's geologic features:_____

Ex: Ocean basins, ocean floor features such as ridges/trenches

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

e. The ocean's influence on the rock cycle:_____

Ex: How the ocean forms rocks that end up on land

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

f. Erosion:

Ex: The effect of moving water on land; the movement of sediments

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

g. The ocean's influence on the weather/climate:_____

Ex: Ocean heat absorption, ocean current heat distribution

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

h. The ocean's influence on the water cycle:_____

Ex: Evaporation off the ocean, condensation, precipitation, runoff

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

i. History of ocean life:_____

Ex: The fossil record of ocean creatures

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

j. Oxygen production:

Ex: The influence of the ocean's photosynthetic organisms

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

k. Ocean ecosystem diversity:

Ex: Coasts, estuaries, coral reefs, oceanic zones, deep ocean, etc.

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

l. Ocean life diversity:

Ex: Adaptations, unique groups of organisms

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

m. Uses of the ocean:

Ex: Food, water, minerals, energy, medicines, oxygen, recreation

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

n. Topics associated with people living near the ocean:

Ex: Transportation, jobs, natural disasters like hurricanes and tsunamis

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

o. Human impact on the ocean:

Ex: Trash, pollution, resource depletion, environmental activism, ocean friendly choices, laws

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

p. People explore the ocean:

Ex: Reasons for ocean exploration, need for ocean understanding

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

q. Collaboration in ocean exploration:

Ex: Communication of ocean-related ideas and information, ocean-related careers

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

r. Technological innovations: _____

Ex: Tools used to explore the ocean

Very frequently.....Frequently....Sometimes....Occasionally....Hardly Ever.....Never/Not Applicable

Space for explanation, if needed:

Thank you for your participation!

APPENDIX K

OCEAN LITERACY POWERPOINT SLIDE TEXT

(Slide One)

Ocean Literacy

What is it and why should we care?

(Slide Two)

The Problem...

• **75% of the planet is covered in ocean water, yet the vast majority of what's covered in environmental education is terrestrial based**

• **“Terrestrialism”—Out of sight, out of mind**

(Slide Three)

History of Ocean Literacy

• 1996—National Science Standards

• 2004—Ocean Literacy Principles

• 2010—Ocean Literacy Scope and Sequence

• Participating Groups: NOAA, COSEE, NGS, Sea Grant, Teachers, Nonprofits, etc.

• <http://www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf>

• http://oceanliteracy.wp.coexploration.org/?page_id=59

(Slide Four)

The Ocean Literacy Principles

• The Earth has one big ocean with many features

• The ocean and life in the ocean shape the features of the Earth.

• The ocean is a major influence on weather and climate.

• The ocean makes Earth habitable.

- The ocean supports a great diversity of life and ecosystems.
 - The ocean and humans are inextricably interconnected.
 - The ocean is largely unexplored.
(BOTH science and environmental)
-

(Slide Five)

Why are the oceans being mostly ignored?

–**Oceans are highly interdisciplinary**

–**May be unsure where to start**

–**May think oceans don't apply to their standards**

(Slide Six)

Why include Ocean Literacy?

We could not survive without the oceans

•**More than 50% of our air**

•**Food**

•**75% of all people on Earth live within 100 miles of the coast**

•**1 in 6 Jobs**

•**Water**

(Slide Seven)

Why include Ocean Literacy?

Our everyday choices affect the ocean

Ex.:Trash Beach(es)□

All our lives are connected to the oceans by our rivers

We all affect the ocean... Not just by oil spills and overfishing!

Major, relatively unpublicized concerns:

Plastics, and eutrophication (dead zones)

(Slide Eight)

Plastics

•GREAT PACIFIC GARBAGE PATCH

- 500+ years to decompose
- BPA—Bisphenol A
 - Marine Life
 - Our food

(Slide Nine)

Fertilizers *(with images)*

(Slide Ten)

Benefits of Ocean Education

•Public support for oceans could help to prevent future oceanic catastrophes like the Gulf Horizon Oil Spill

•AAAS

- Scientific Literacy
- Less is more
- Depth vs. Breadth
- Applied

(Slide Eleven)

Ocean Literacy

- Almost any subject can include these topics
- Matrix for National Science Standards
- Other things YOU can do:
 - Sustainable seafood selection choices
 - Model ocean eco-friendly behaviors**
 - Pick up trash
 - Conserve water
 - Recycle/Reduce plastic consumption
 - 7 day plastic challenge

(Slide Twelve)

Research Questions

What are the effects of an experiential marine science course on teachers' conceptualizations and classroom inclusion of Ocean Literacy?

(Slide Thirteen)

Questions?

(Slide Fourteen)

References

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- National Research Council. (1996). National Science Education Standards. National Academy Press: Washington, D.C.
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- U.S. Commission on Ocean Policy's Report to the President and Congress. (2004). *An ocean blueprint for the 21st century*. Washington D.C.

Thank you!!

APPENDIX L
POST-ASSESSMENT

Name: _____

Project ISLE: Content Knowledge Post-Assessment

The purpose of this assessment is to evaluate the effectiveness of the Project ISLE program. This assessment examines your knowledge development and the progression of some non-cognitive traits such as your attitude and behaviors concerning some of our Project ISLE topics. Please answer to the best of your ability.

Part One: Content Knowledge

1) A star's color provides information about its:

- a) Size
- b) Distance from the Earth
- c) Chemical Makeup
- d) Temperature

2) Which of the following types of volcanoes make up the Hawaiian Islands?

- a) Flood (or Plateau)
- b) Shield
- c) Composite
- d) Cindercone

3) Which of these is true about erosion?

- a) erosion only happens quickly
- b) erosion only happens to rocks
- c) erosion only happens slowly
- d) erosion can happen quickly or slowly

- 4) Certain areas of Hawaii have black sand beaches because of:
- a) indigenous congregations of black-shelled oysters
 - b) splatter where lava hits ocean water
 - c) erosion from volcanic rocks
 - d) wild fires that are common in those areas
- 5) Which types of living things are there the most of in the ocean?
- a) fish
 - b) plankton
 - c) animals with shells
 - d) whales and seals
- 6) In which of these places would you find the most ocean life?
- a) every part of the ocean has the same amount of life
 - b) warm waters near the equator has the most life
 - c) the middle of the ocean far from land has the most life
 - d) cold waters near the coast has the most life
- 7) Which of the following represents a problem that threatens an unusually large number of Hawaii's marine and terrestrial species?
- a) Agricultural runoff.
 - b) Hydrocarbon pollution
 - c) Hunting and fishing
 - d) Introduced species
- 8) Which of these reproductive strategies do parrotfish use?
- a) Females can turn into males.
 - b) Males care for the young.
 - c) They build nests in coral reefs.
 - d) They form mating pairs.
- 9) In the last several decades, the environment around the Puna District of the Big Island has been dramatically changed as a result of
- a) human development.
 - b) a hurricane.

- c) coastal erosion.
- d) a volcanic eruption.

10) It is likely that the fish pictured below eats:

- a) Plankton
- b) Other fish
- c) Algae
- d) Coral



11) The fish below is a:

- a) Golden Eyed Surgeonfish
- b) Golden Eyed Butterflyfish
- c) Golden Eyed Angelfish
- d) Golden Eyed Sunfish



12) The lateral line in a fish

- a) is used to signal other fish.
- b) is a sensory organ.
- c) helps the fish move through the water.
- d) runs ventrally along the fish's body.

13) Techtronic activity affects the ocean in the following ways:

- a) by providing the ocean with chemicals
- b) influencing the ocean's shape
- c) influencing oceanic heat distribution
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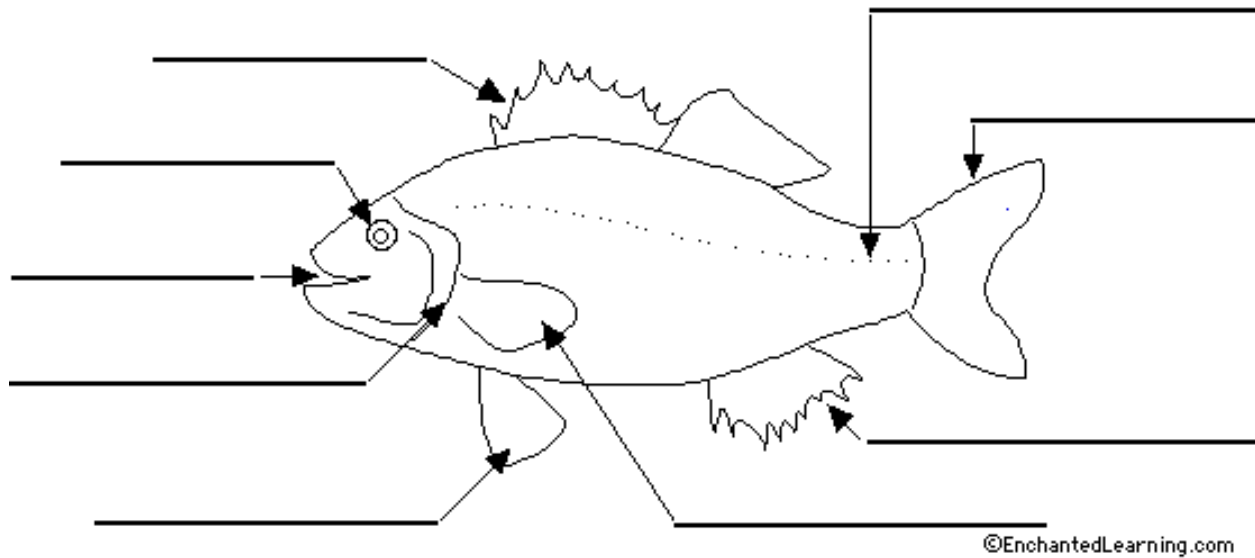
14) The deep valleys found on the windward sides of the Hawaiian Islands are formed mainly by:

- a) Volcanic activity.
- b) earth quakes.
- c) erosion.
- d) the impact of organisms.

- 15) Coral live in a very close symbiosis with
- a) Zooxanthellae
 - b) Polyps
 - c) Cnidaria
 - d) Nematocysts
- 16) The most important way to respond to threats to Green Sea turtles (aka Honu) is
- a) to protect the coral reefs.
 - b) to protect their nests.
 - c) to protect their food supply.
 - d) to protect their migration routes.
- 17) The largest volcano in the solar system is on
- a) The earth.
 - b) Venus.
 - c) Mars.
 - d) Jupiter.
- 18) The decision to reclassify the object formerly known as the planet Pluto was made because of new information about
- a) Kuiper belt objects.
 - b) extra-solar planets.
 - c) the Oort cloud.
 - d) Pluto.

19) Label the parts of the drawing below:

Mouth, eye, operculum, anal fin, caudal fin, dorsal fin, pectoral fin, pelvic fin, lateral line.



20) Which science disciplines factor in to the study of oceanography?

- a) chemistry
- b) biology
- c) physics
- d) all of the above

Part Two: Beliefs, Behavior, and Exposure

21) *(To what degree do you agree with the statement?)*

“I feel comfortable in outdoor, natural settings.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

22) *(To what degree do you agree with the statement?)*

“Each of us has a personal responsibility to protect the ocean”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

23) (*To what degree do you agree with the statement?*)

“I have no effect on the oceans since I live so far from them.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

24) (*To what degree do you agree with the statement?*)

“I contribute to the problems facing the ocean.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

25) (*To what degree do you agree with the statement?*)

“I feel a sense of amazement and appreciation for ocean life.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

26) (How often do you...)Make an effort to conserve water in your daily life?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

27) (How often do you...)Recycle paper, plastics, glass, and other materials

- a) Never
- b) Rarely
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- e) Always

28) (How often do you...) Pick up litter?

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29) (How often do you...) Avoid buying seafood that is overfished or caught/farmed in ways that harm the ocean?

- a) Never
- b) Rarely
- c) Sometimes
- d) Often
- e) Always

30) (*To what degree do you agree with the statement?*)

“I would support efforts to protect the marine environment, even if it meant paying more for seafood or closing certain beaches to the public.”

- a) Strongly disagree
- b) Disagree
- c) Agree
- d) Strongly agree

Any additional comments?

APPENDIX M

FALL PLANNING FORM

Project I.S.L.E. Fall Planning Form

In order to accurately plan for follow up observations, please complete the questions below regarding your current estimation for when you will teach the material from the Project ISLE program. The dates and times do not have to be firm at this point, and we will contact you well in advance to set up convenient meeting times. Thank you!

Name: _____ Email: _____

Grade Level: _____ Subject: _____

School: _____ Title: _____

To the best of your ability, please fill out the chart below:

Project ISLE Content Material	Name of current unit	Approximate dates of material implementation
<i>Ex: Fish identification</i>	<i>Ex: Six Kingdoms</i>	<i>Ex: ~Sep 15-21</i>

APPENDIX N

POST-SURVEY QUESTIONS

Ocean Literacy Survey Part II

Personal Information

1. *(Remember: All information will be kept strictly confidential, and all identifying information will be deleted from any reports or publications.)*

Name:

Email Address:

Ocean Literacy Questions

Please answer these questions with as much detail as possible. Remember, all information will be kept confidential.

1. What are the most valuable lessons you learned during Project I.S.L.E.?
2. How (if at all) did your definition of “Ocean Literacy” change as a result of this course or as a result of your participation in this study?
3. Please describe your personal opinions or beliefs regarding the value of Ocean Literacy as a curricular topic.
4. What impact (if any) did Project I.S.L.E. have on the point of view you described in Question 3?
5. What influence do you believe people have on the oceans? Which Project ISLE experiences helped you come to/develop this perception (if any)? Please explain.
6. Conversely, what influence do you believe the oceans have on people? Which Project ISLE experiences helped you come to/develop this perception (if any)? Please explain.

7. What types of attitudes do you believe that an "Ocean Literate" student would have?
8. What types of behaviors do you think you would see an "Ocean Literate" student doing?
9. What impact do you expect the information in this course to have on your curriculum? Please provide examples, if possible.
10. Anything else to add...

Thank you for your participation!

APPENDIX O

INTERVIEW PROTOCOL

Teachers' views of Ocean Literacy after Project ISLE

Information about the Ocean Literacy interviews:

There will be eleven 20-30 minute interviews with each of the participants that stayed the full time for Project ISLE. All three interviews will contain the following open-ended questions found in this script and will be administered in a semi-structured format in person or over the phone.

Script for Ocean Literacy Interview:

Hello _____, thank you for meeting with me. It is good to see you again.

As I told you in Hawaii, I am collecting data for my dissertation concerning teachers' beliefs about Ocean Literacy, and how Project ISLE impacted your teaching of Ocean Literacy. First of all, thank you for participating in my study. Your responses in the two surveys were very insightful. However, the surveys don't tell the whole story. I'd like to know more about your thoughts on the topic and how it is playing you in your classroom.

The consent form you signed earlier this summer mentioned that I may ask you to participate in a follow up interview. Our discussion should take about 20-30 minutes. Some of the questions will sound similar to the ones seen on the surveys, while others will be new. Also, just like with the surveys, participation in the interview is completely voluntary, and you can stop the interview at any time without penalty. Also, every piece of identifiable information in the interview will be kept strictly confidential. To help me analyze the results, I would like to audio-record the interview with your permission. I'll use the recording to type out a verbatim transcript of our discussion. I can provide a copy of this transcript to you, if you wish. Do you have any objections to recording our conversation? OK, let's begin.

Teachers' understandings of Ocean Literacy

1. To start us off, in your own words, how would you define Ocean Literacy?

-Did Project ISLE influence your definition of OL? If so, in what way?

2. What do you consider to be the most important concept or concepts for students to understand about the ocean?

-How (if at all) do you include this concept into your classroom?

3. How would you describe your own level of Ocean Literacy?

-If not, who would be an example of someone who is?

The affects of the summer program on teaching:

4. Now I'd like to discuss Project ISLE in a little more detail. Let's say a friend asked you what you learned in Project ISLE. I know we learned a LOT, but how might you summarize your experience?

5. What impact, if any, have your experiences in Hawaii had on your teaching?

6. If I were to sit in on the unit you created for the course this summer, what would I see?

-How did you decide on this topic?

-How did your students react to the unit, or how do you expect your students to react?

7. Obviously, we saw a wide variety of things in Hawaii, but what events or activities from this course stand out to you the most?

-What have you told your students about that particular experience? What were their reactions?

8. If you were in our shoes and were designing a professional development course for next summer, would you change anything about the course in order to increase participants' Ocean Literacy?

-How would that help teachers understand Ocean Literacy?

9. Now that you have completed the program, I'd like to know your thoughts, if any, concerning your original expectations of the program compared to now...

Conclusion:

Is there anything else you'd like to share about Ocean Literacy or your teaching of ocean science concepts? If not, then thank you for sitting down with me today. Your responses will be very helpful. If I happen to come across any other questions while transcribing the recording, would it be possible to contact you again? Thanks again, and I hope to see you again soon.

APPENDIX P

GROUP INTERVIEW PROTOCOL POWERPOINT SLIDE TEXT

(Slide One)

Welcome!

- 4:00-4:35—Catch up and enjoy refreshments
- 4:35-5:00—Discussion of what's going on in your classrooms and schools

Closing—Items to consider moving forward

.....

(Slide Two)

What's going on in your classrooms?

- How are you using the material from Project ISLE in your classroom?
 - (Or how are you planning to use the material?)
 - One lesson? Series of lessons?
 - Share artifacts (if applicable)
 - What have been student reactions?
 - Any innovative ideas to share?
 - In what ways have you tied in the Hawaiian culture?
-

(Slide Three)

Discussion

- Questions about incorporating the material?
 - I really want to do a lesson on _____, but not sure how...
 - Is Project ISLE affecting your schools beyond your individual classrooms in any way?
 - How have your stories from the trip affected your lessons?
 - Standards—How (if at all) does ISLE fit?
-

(Slide Four)

Looking forward

- Observations— “2 hats”
- Interviews
- 20-30 minutes
- In person or on the phone (whichever’s easiest)
- Subway, iTunes, or Starbucks gift card as a thank you!!

(Slide Five)

Consent Form

- Your info is even better than I thought it would be!
 - IRB Second form—take two, please
-

APPENDIX Q
CONSENT FORM 2

September 15, 2011

Dear Project ISLE Participant,

Thank you for your continued participation in my dissertation study. The information from your surveys, course materials, etc. has been invaluable additions to my research, and I truly appreciate your time and efforts. In fact, the input I received from you has been even more valuable than I anticipated, which is the reason for my correspondence today. The Project ISLE experience resulted in some surprisingly rich data sources, which were not originally included in the Informed Consent that you received at orientation. For example:

1. The essays you wrote in your Project ISLE applications describe detailed accounts of your beliefs about teaching, which correlate directly with my project.
2. Several of you sent me pictures of bulletin boards and other classroom materials displaying your usage of the Project ISLE content.
3. Four of you chose to keep a travel blog while on the trip, which has proven to contain rich descriptions of course content.
4. Finally, many of you have sent me emails describing classroom usage of Project ISLE material and reflections as to how the inclusion of course material went.

According to the _____ Institutional Review Board, I am required to receive consent to use the items listed above as part of my dissertation.

****Please indicate below which data sources I may use (Please use initials):**

- The researcher may examine and analyze the content of my application essay to the Project ISLE program. Yes_____ No_____ [Please use initials]
- The researcher may analyze emails to her containing pertinent information about my usage of the Project ISLE materials in my classroom or school. Yes_____ No_____ [Please use initials]
- The researcher may take photographs of my instructional materials that demonstrate my inclusion of the program material such as bulletin boards or project examples. However, student work or students images will never be photographed by the researcher. Yes_____ No_____ [Please use initials]
- The photographs I send the researcher of instructional materials I create as a result of this course (such as bulletin boards, example projects, etc.) may be analyzed and reproduced to support this research. If requested, photographs taken by you will be credited if published. Yes_____ No_____ [Please use initials]
- The researcher may examine and analyze the content and photographs of an optional travel blog of my experiences during Project ISLE. Yes_____ No_____ N/A_____ [Please use initials]

Again, your participation is voluntary, so should you choose not to include the additional data sources listed above, your decision will not have an effect on your class standing, PLU status, etc. You are free to withdraw your participation at any time, should you think it necessary. Also, if you have any questions or concerns, feel free to contact me at 404-731-4757 or at clinsky@uga.edu. I hope you will enjoy this opportunity to share your experiences and viewpoints with me. Thank you very much for your help.

Sincerely,

Catherine Lindsay Linsky
 Doctoral Student, Department of Math and Science Education
 University of Georgia
clinsky@uga.edu

Advisor:
 Dr. Seth
 Department of Math and Science Education

Signature of Participant

Date

Printed Name of Participant

Signature of Researcher

Date

