‘A‘OHE PAU KA ‘IKE I KA HĀLAU HO‘OKĀHI:
ALL KNOWLEDGE IS NOT TAUGHT IN THE SAME SCHOOL:

A MULTIPLE-CASE STUDY ON THE NAVIGATION OF PERSONAL,
CULTURAL, AND PROFESSIONAL IDENTITIES OF
NATIVE HAWAIIAN MEMBERS OF HAWAI‘I’S SCIENCE, TECHNOLOGY,
ENGINEERING, AND MATH COMMUNITY

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DEDICATION

This research and dissertation is dedicated to the people of Hawai‘i of all ages, backgrounds, gifts, and talents. May you use this research to do good and to do well.
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There are so many people to thank who have had a hand in influencing me personally and professionally throughout this process.

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ABSTRACT

This project was a multiple-case study of the life stories of ten individuals of Native Hawaiian ancestry who have made beautiful lives for themselves in science, technology, engineering, and math. Each participant’s oral narrative was related over three one-hour periods in which they were interviewed in a semi-structured format. The focus of the first interview was life context and life history. Each second interview built on the biographical background from the previous interview and focused primarily on cultural and scientific areas of expertise. The third interview directed the participants to reflect on themes/meanings both individually and collectively. The themes gleaned from their experiences give a deeper understanding of the experiences being Native Hawaiian members of the STEM community and the challenges and opportunities that come from merging, separating, and navigating the sometimes treacherous waters of personal and professional identities. Their respective stories represent their inspirations, influences, challenges, and experiences. Initial coding of each narrative revealed four major themes: identity salience, personal/cultural connections to science, a Hawaiian doing things vs. doing Hawaiian things, and being a first generation Native Hawaiian scientist.
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How is/are identities experienced and constructed?

What are the sociocultural/historical/political contexts that influence and shape identity?

What are the personal, social, and professional contexts that influence identity salience?

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CHAPTER 1. INTRODUCTION AND OVERVIEW OF RESEARCH QUESTIONS

‘A‘ohe pau ka ‘ike i ka hālau ho‘okāhi
All knowledge is not taught in the same school.
One can learn from many sources.
(#203 Pukui 1983, 24)

In her works, Mary Kawena Pukui challenges us to nānā I ke kumu, look to the source, for mental, physical, and spiritual nourishment as well as knowledge and enlightenment. The source of this knowledge begins with words. Words have the power to influence our hearts and minds. We have only to open ourselves to accept the teachings that are being shared with us. Those who take these teachings and apply them increase their own knowledge: E lawe i ke a‘o a mālama, a e ‘oi mau ka na‘auao (#328 Pukui 1983, 40). However, Pukui and other scholars acknowledge that there is more than one source for this knowledge: ‘A‘ohe pau ka ‘ike i ka hālau ho‘okāhi. In this project we look to ten sources of knowledge: Lawai‘a, Keala, Melemele, Pōmaika‘i, Keli‘i, Hīhīmanu, Kahelelani, Hoku, Kaipo, and Aloha². Their respective stories including inspirations, the influences, the challenges and experiences as both their Native Hawaiian and science, technology, engineering, and mathematics (STEM) identities intersect, interact, conflict, merge, balance, and are navigated.

In December 2009 I attended the annual Philosophy of Education Society of Australasia conference that was held at the East-West Center where I sat in on many discussions by, for, and with Indigenous researchers. One panel discussion with members of the Ho‘okulāwi Center for Native Hawaiian and Indigenous Education called Breaking Trail or Breaking Wind?: The Politics of Indigenous Research stands out in particular because it gave me the opportunity to ask a very important question in a room full of researchers who are Indigenous and/or focus on Indigenous research: “As a
non-Indigenous person, interested in Indigenous research, where do I fit in the spectrum of Indigenous Research? Do I have a role a play? If so, what is that role?” Dead silence. The answer I received, after what can be described as a very meaningful pause, stressed that I do have a role and that there are four elements I should keep in mind as a non-Indigenous person participating in the field of Indigenous research: 1) I be honest about who I am and clearly locate myself within the contexts of my research, 2) I be honest about my motives as they relate to my research, 3) I conduct research that will be beneficial to the Hawaiian/Indigenous community, and 4) I be sensitive to the impact of colonization on the Hawaiian/Indigenous community.

Throughout my PhD program, the composition of my research proposal, my research with ten amazing individuals of Native Hawaiian ancestry, and the writing of this dissertation I have tried to be mindful of the answers I received that day. It guided the framework of this research project – a narrative multiple-case study research project that enables the participating Native Hawaiian members of Hawai‘i’s science community to play an active role in meaning making and takes in to account multiple identities that they possess.

I would like to consider that identities are not narrowly constrained and that multiple dimensions of identity intersect and interact with identity salience determined as much by overall experiences as an immediate event. Do different identities intersect with each other and, if so, how? Do particular identities support and enhance one another? Do particular identities distract from one another? How is identity formed with multiple identities are taken in to consideration? What are the experiences of Native Hawaiian members of the science community when these multiple identities are considered? How
are these identities experienced and constructed? How do these identities intersect and interact? How is salience determined? Why should we be interested in Hawaiian identity as it pertains to science and science education?

As a person whose passion for science stems from both formal and informal “scientific” experiences, I am curious as to how and why other people have come to share my passion for science. As a science teacher I have experienced first-hand the joys and the frustrations and anger of students in my science classes and am constantly looking for new ways to support their learning. There have been too many times to count when people have responded to news that I am a science teacher with “I am/was not good at science,” or even worse, “I hate(d) science.” Tobin & Roth note (2007) “such utterances are not just statements about some anonymous electron, proton, or other scientific object. These are statements about the speaker him/herself” (340). Phrases such as these identify people as being excluded from science for one reason or another. Among those who have been most excluded are females, Indigenous Peoples, and African-Americans.

**Research Statement**

This case study explored the lived experiences of identity construction and negotiation of ten (10) Native Hawaiian members of Hawai‘i’s STEM community when multiple identities are considered.

**Research Questions**

The purpose of this research was to explore the complexities of identity development using a critical case study approach and draw upon the results to explore the relationships between intersecting, and potentially contrasting/supporting, identities. Previous research I conducted for my Master’s degree with Native Hawaiian members of Hawai‘i’s STEM
community as well as similar research with other ethnic groups in the sciences aided in the creation of the overarching research questions. The guiding research questions are:

1. What is the lived experience of identity construction and negotiation when multiple identities (Hawaiian and Scientist) are considered?
2. How is/are identity(ies) experienced and constructed?
3. What are the sociocultural/historical/political contexts that influence and shape identity?
4. What are the personal, social, and professional contexts that influence identity salience?

**Locating Myself Within The Research**

Where do I fit? After all, I am not Hawaiian nor was I born in Hawai‘i. For these reasons I will always be, ethnically speaking, an outsider looking in. I am comfortable in this role since it has been a continuous theme throughout my life starting as one of the few (and at times the only) non-black/Hispanic student in Trenton’s inner-city schools. I attended high school in a very small rural community in New Jersey where I was in the ethnic majority but social and cultural minority. Then moving to Hawai‘i sight-unseen following college to join a new ethnic, social, and cultural community that was very different from where I was raised.

Why I am drawn to the Hawaiian people and Hawaiian culture is difficult to address and even more difficult to quantify. In a recent article entitled *Do Scientists Overreach?* (2011) on National Public Radio’s (NPR) website Marcelo Gleiser said, “science paints a wonderful picture of the world, but a necessarily incomplete one. To reduce everything…impoverishes humanity” (2). There may also be resonance between the trauma experienced by Native Hawaiians and my Jewish ancestors who survived
persecution for thousands of years and my more recent Jewish family members, some of whom survived and some of whom were lost, in the Holocaust. It could also be a reflection of my experiences growing up among people of color and later, in high school, when I was a social and cultural outsider despite being the same ethnicity as my peers. One could also blame Star Trek (both the Original Series (TOS) and The Next Generation (STTNG)) reruns and Gene Roddenberry’s concept of a universe where not only was it possible for humanity to see past its differences and come together on a planetary scale, but that humanity was able to identify and connect with other sentient species on other worlds based on mutual respect, values, and ideals. Part of it may be the influence that Native American stories and rituals played out and enacted in my many years of scouting on my way to being an Eagle Scout, being made aware of and connecting with the natural world in intimate ways.

It may also be because when I got off the plane when I first arrived in Hawai‘i, not having a place to live or knowing anyone, I felt a sense of calm wash over me that told me I was exactly where I belonged. Maybe my first years of teaching, years that often have a profound impact, on the Leeward Coast in a predominantly Native Hawaiian community indelibly affected me emotionally, spiritually, and intellectually. What I found when I arrived in Hawai‘i was a community of people that accepted me for who I am and were willing to teach me how to navigate not only within the Hawaiian community in which I worked and lived, but also the larger “local” community in Hawai‘i.

I am not Hawaiian…

The support that I receive from the Hawaiian community fuels my passion to support programs directed specifically towards Native Hawaiian students. I am not Hawaiian. I
do not pretend to be Hawaiian. I will never be Hawaiian. But, like many other non-Hawaiians, I have an intense respect and love for the Hawaiian people, culture, and knowledge. That being said, the fact that I am a non-Hawaiian looking to do research with Native Hawaiians presented some challenges during this research project. Contrary to the spirit of this research – recognizing and embracing multiple dimensions of identity – the binary identity dynamic that had the potential for the greatest challenge was the white/non-white dynamic that existed between myself and all of the participants. Issues in regards to this dynamic are covered later in the chapter in the discussion on historical and cultural context of education for Native Hawaiians.

As a non-Hawaiian working with Hawaiians, there was the potential for the development of power issues where the participant(s) viewed me as the physical embodiment of colonization, oppression, and subjugation of the Hawaiian people and their culture. The simple fact that interviews were conducted in English, because I do not speak Hawaiian, could have been construed as a form of continued colonization. This historical personification could have caused participants not to participate, not cooperate, and/or not share information during the interview process that they may share with someone who is of Native Hawaiian ancestry.

I cannot change the fact that the Hawaiian/non-Hawaiian dynamic exists. However, there were certain steps I took to mitigate the potential for challenging situations (a detailed explanation of my methodology and methods are provided in Chapter 3). This process began by being completely open and honest with each of the participants about myself, the purpose of this research project, the overall process I intended to follow, and the intended benefits to both the Hawaiian and Science communities. Each participant
was asked to sign a release form (see Appendix D) with the aforementioned details. The overall theoretical framework – an intersection of grounded theory, case study, and Indigenous Methodologies – created an active role for the participants to be co-creators of the themes and in the meaning making of both their own stories and collective experiences. Even though I am the primary researcher, each of the participants had multiple opportunities to review their own narratives, edit, and address the themes within their own life story and the life stories of the other participants. In this way, we were partners in this research. Narrators\textsuperscript{6} were encouraged to share their experiences in a variety of ways including, but not limited to, stories, photographs, legends, jokes, songs, chants, analogies, and metaphors. This wide range of methods enabled them to express their experiences in their own way.

Wilson and Bird (2005) note that “the first step toward decolonization…is to question the legitimacy of colonization” (3). Once recognized, Wilson and Bird continue, “we can think about ways to resist and challenge colonial institutions and ideologies” (ibid). Freire (1998, 2000), Laenui (2000), Smith (2004), Wilson and Bird (2005) also note, this is not a passive process. This process begins within the mind of the Indigenous individual and the collective consciousness of Indigenous groups. However, we as a society must also recognize the legitimacy of the trauma suffered by both past and present members of Indigenous groups such as Native Hawaiians. Lastly, the most central method of addressing potential ethnic differences is embedded in the overall premise of this research project. Recognizing, acknowledging, and celebrating our multiple dimensions of identity allows for the participants and I to connect with each other in ways other than those based solely on ethnicity.
...but I am a Science Teacher

While I am not Hawaiian, I am a high school science teacher and someone who actively participates in Hawai‘i’s science community, one of many dimensions of identity I can potentially share with participants. How did I get into science? Why am I into science? I have always thought science was fun and interesting, and I could not understand why everyone did not agree. Maybe it is the white coats that scientists wore on television and in movies. Maybe it was because scientists could go in to the mysterious back rooms of museums and laboratories. Maybe because it provides some level of explanation about a chaotic universe that I find psychologically comforting. I have always thought science and scientists were cool. It is not that I have an urge to categorize everything in the world or to try to explain everything mathematically and create “laws” that dictate natural processes. I am a naturally curious person, and I feel comfortable with other curious people.

This curiosity was supported and fostered by a variety of people and activities. I have had my share of excellent science teachers (and a few terrible ones) in both high school (Mrs. Stramara, Mr. Demyon, and Dr. Fink) and college (Drs. Orr, Rusiloski, and Weber). While they emphasized what is commonly referred to as “school science” they connected it to the world around us, made it fun, and held me to a very high standard. Drs. Fink and Orr (both of whom have recently passed away) were particularly influential. Dr. Judson Fink, who taught university level physics for 30+ years (my mom was one of his students) came out of retirement to teach high school physics. It was obvious from the way he talked and taught that he loved both physics and teaching. Dr. Robert Orr, one of my chemistry professors and mentors in college, loved working with college students but also enjoyed showing off the fun side of science. He did chemistry
demonstrations for elementary students during our annual open house and helped to organize the annual regional Science Olympiad tournament on campus. Both of these influential teachers guided me through the rigors of science. They also taught me that science was fun and instilled in me a passion to share that fun with others.

My parents were also a huge influence and did a great job of fostering my interest in science through mini experiments at home. They worked with me on countless science fair projects. There were also many unofficial experiments such as the discovery that the mixture of brake fluid and granulated chlorine crystals caused an explosive reaction. This particular discovery led to an entire afternoon of experimentation with my best friend Tony (overseen by my dad), several bottles of brake fluid, and at least two trips to a local pool supply company. Because my mom was a teacher, she shared our summer breaks. Those breaks were filled with hiking and camping (with the Boy Scouts as well) and countless trips to museums and planetariums up and down the east coast of the continental United States. My parents also fostered my love of science fiction especially authors such as Isaac Asimov and Arthur C. Clarke as well as television shows and movies like *Doctor Who*, *Star Trek*, and *Star Wars*. These, I feel, not only influenced my love of science but established a larger view of role of individuals and groups, their impact on the universe, and opened the door to a variety of metaphysical and existential topics that have influenced my interest in this research topic.

Since my first year of teaching, at Nānākuli High and Intermediate School, I have sought to make science fun, accessible, and meaningful for students within their own personal paradigm. Science is fun and exciting and the process of science (not to be confused with the politics of science) is about learning about the world around you.
always try to incorporate what students already know about their world and what they see every day to expand rather than contradict or negate that knowledge. Most importantly, I try to show them that what we call “science” is something that we do everyday and you do not need a fancy degree or to use big technical terms to “do science.” To me, there is no better feeling than walking along the path of knowledge with your students and discovering something together, seeing the light bulb go on in their eyes and knowing that they get it.

Motivations for this Research Project

How did I become interested in multiple identities?

It is extremely difficult for me to pinpoint a moment in time or an “aha” moment when I realized I was interested in multiple identities. Interest in who I am and who others are in relation to each other is something in which I have always been interested. I am sure being made keenly aware of my whiteness throughout my early childhood influenced my interest in multiple dimensions of identity and thinking. Sometimes I would ask myself, “is ‘white’ all I am?” There were also discussions throughout Hebrew School about whether we were Jewish first or American first. I remember being quite confused and thinking, “why can I not be both? Why do I have to choose?” I also recall an untold number of frustrated coaches who continuously urged my teammates and me to “get angry” at the other team. Needless to say they did not take kindly to me questioning the logic of being angry with someone based on the geographic crapshoot that resulted in us living in different school districts.

I feel that my interest is also influence by my experiences with people, particularly in Hawai‘i, who have been accepting of my multiple dimensions of identity just as I have been accepting of theirs. People who helped me to adjust to my new home and did not
see me as a “mainland haole” but as someone who cares deeply for his students on multiple levels and cares about making Hawai‘i the best place it can be.

My parents and family were and are still sources of inspiration in terms of multiple identities. My parents have always been actively involved in a variety of activities and causes. Involvement in political activism, scouting, boards, and positions of leadership within religious and community institutions as well as being parents has given me an appreciation for someone who “wears many hats.” This has not only influenced my interest in multiple dimensions of identity, it has also influenced my desire to play an active role within Hawai‘i’s local community as well. As a result, much to the frustration of my wife, I am active in a variety of science-related organizations including the Hawai‘i State Science Olympiad, Hawai‘i Academy of Science, and Hawai‘i Science Teacher’s Association. I am also active within my school and local community volunteering with organizations like Special Olympics.

As someone who has made an academic and professional career in science, I have found the lives and stories of both famous and not-so-famous scientists to be a source of inspiration particularly in the realm of multiple identities. Scientists are often portrayed, unfortunately, as one-dimensional and dispassionate. Peering in to the complex lives and psyches of scientists such as Robert Oppenheimer, Rosalind Franklin, Linus Pauling, Friederich August Kekule, and Rachel Carson gives a more accurate picture of their personal and professional influences, passions, struggles, and successes. It also adds depth to the contributions each has made to the larger body of knowledge both in and out of science.
Not-so-deep-down I am a science fiction geek. The science fiction genre, particularly the characters and themes presented in television shows and movies such as *Doctor Who* (Newman 1963, 2005), *Star Trek* (Abrams 2009, Baird 2002, Carson 1994, Eberl and Decker 2008, Frakes 1996, 1998, Meyer 1982, 1991, Nimoy 1984, 1986, Roddenberry 1966, 1987, Shatner 1989, Wise 1979), and *Star Wars* (Kershner 1980, Lucas 1977, 1999, 2002, 2005, Marquand 1983) have been hugely influential not only on my love of science but also for the relationships between sentient beings, non-sentient creatures, and technology (i.e. androids and robots). For as long as I can recall, these particular television shows and movies and the characters within them have fascinated me, and I believe that they are a key influence to my interest in multiple dimensions of identity. As Gene Roddenberry, creator of the *Star Trek* universe, has noted, “Science fiction is a remarkable device for looking at the human creature and into the human condition [and it] may be one of the last places in our society where the philosopher can roam just as feely as he chooses” (Eberl and Decker 2008, xvii).

Fictional characters allow us the luxury of exploring various aspects of the human condition without being impeded and overwhelmed by the emotional reality of an actual person. *Star Wars* and *Star Trek* have enabled us explore both real and existential issues close to home and in galaxies far, far away. These universes explore the relationships that exist within organizations and social structures (the Federation (Star Fleet), Borg, Klingon, and Romulan Empires in *Star Trek* and the Republic, Jedi Order, the Empire, and the Rebel Alliance in *Star Wars*) and how they react collectively to internal and external threats. Are members of the Rebel Alliance “freedom fighters” or “terrorists?” What can the Prime Directive teach us about interacting and interfering in the
development of other cultures? Why should we resist being assimilated by the Borg when social norms encourage us to assimilate anyway? These shows and movies challenge us to look at issues and questions of organizational purpose from different perspectives and learn that “good” is a point of view (Decker and Eberl 2005, Eberl and Decker 2008).

We also gain the opportunity to explore the sociological struggles particular characters face as they explore the multiple dimensions of their own identities. *Star Trek: The Original Series* (TOS) introduced us to multi-ethnic characters such as Spock who was literally a “child of two worlds” being the son of a Human mother and Vulcan Father. *Star Trek: The Next Generation* (STTNG) introduced us to Data and Worf, the first android and Klingon to serve in Star Fleet respectively. Each of these three characters is forced to reconcile the dimensions of their identities to navigate successfully through life. Spock, in TOS, explores the balance between his own human emotionality and unemotional logic. Throughout STTNG Data, who strives to be more human-like, questions with both child-like innocence and intellectual cunning what it means to be human and Worf, who was orphaned and raised by human parents, socially and psychologically navigates being the only Klingon on mostly-human ship while not being accepted by other Klingons.

The character of The Doctor in *Doctor Who* takes the idea of multiple of dimensions of identity quite literally by regenerating throughout the long-running series. The Doctor’s 11 different incarnations, each with his own distinct style and personality, challenge us to think about the spatiotemporal continuity of identity without the spatiotemporal continuity of the body (Lewis and Smithka 2010). Despite the fact that
this type of bodily discontinuity does not exist in real life it challenges us to think about our own identities fourth dimensionally (over time) in what philosophers such as Ricoeur calls “person stages.” Philosophers such as Derek Parfit (1984) challenge us to consider whether our earlier identities have an impact on our later identities? If so, what responsibility do our earlier “selves” have to our later “selves?” Along these lines, my “later self” has maintained the same passion as my “earlier self” with regard to connecting students to science. As a new teacher at Nānakuli High and Intermediate School, this passion led me to find ways to connect my students’ personal and cultural experiences with the science we were doing in the classroom.

How did I get to the point of asking questions about Hawaiians in science?

Hawaiians were and are great scientists. The skills ancient Polynesians had to have to voyage across the Pacific in terms of celestial navigation and engineering are amazing. The ability of ancient Hawaiians to effectively and efficiently manage huge areas of land to support thousands (some say millions) of people and to master agriculture both on land and sea are inspiring. Yet so few science teachers and scientists are Native Hawaiian. There are, of course, both cultural and historical reasons behind the lack of Native Hawaiians entering the sciences and these reasons are explored both in this chapter, the literature review in Chapter 2, and through the themes gleaned from the narratives of the participants in this project. Thanks, in part, to the efforts of organizations like the Pacific American Foundation, Kamehameha Schools, the Bishop Museum, and the University of Hawai‘i’s Curriculum Research and Development Group there has been extraordinary growth in the amount of cultural and place-based science curriculum and workshops to inspire students on Native Hawaiian ancestry. Yet the number of Native Hawaiian students pursuing degrees in science, technology, engineering, and math still remains

I developed this research project to address this question. Talking to today’s Native Hawaiian scientists, science teachers, and science students will give me a better understanding of what hooked them in to science and of their individual and shared experiences being scientists of Native Hawaiian ancestry. There is a growing body of literature that details the experiences of Hawaiian scientists whose chosen scientific profession is easily connectable to Native Hawaiian culture and traditional practices. This has led to some of the aforementioned placed-based and culturally based curriculum. However, there is a lack of literature regarding Native Hawaiians in fields that do not connect as easily to traditional culture and practice. What are the experiences of Native Hawaiian geneticists, physicists, chemical/electrical engineers, and doctors? Because their professions do not connect as easily to traditional Hawaiian culture and practice as an environmental biologist, does this make their experiences any less valid and valuable?

Like Appiah (2006, 2007) and Sen (2006), this project considers and appreciates the existence and reality of multiple dimensions of the participants’ identity. Although each participant has had similar experiences with respect to their Hawaiian and scientist identities, their experiences are not identical and have not led them to the same conclusions. All of the participants in this project are Hawaiian, however their “Hawaiian experience” was very different and resulted in different attitudes with regards to the cultural dimension of their identity. The experiences of today’s scientists from all branches of science can drive curriculum development, counseling methods, and even teaching strategies to help today’s Hawaiian students become tomorrow’s Hawaiian
scientists. My aim in this dissertation is to share what I learned from ten Native Hawaiian members of Hawai‘i’s science community. I will share what fired their imaginations to the point that they decided to dedicate their academic and professional careers to pursuing degrees and careers related to science.

Why are some Native Hawaiian students attracted to science, technology, engineering, and math while others are not? Is it personal? Is it historical? Is it cultural? Is it a combination of these factors? Are there other factors involved in the decision? Lastly, once they have made the decision to become a scientist, what is the impact on their Hawaiian identity (and vice versa)? Both the data and analysis of this project represent an in-depth theoretical and philosophical exploration of identity for ten unique individuals.

I do not just sit around pondering the interactions and intersections of multiple dimensions of identity as they relate to science. It is, however, a topic that I have thought about for some time. All of the aforementioned dimensions of my identity have led to my interest in investigating identity salience with Native Hawaiian members of the science community, particularly when the intersections and interactions between these particular identities are considered. The benefits to me, as the researcher and the one pursuing an advanced degree, are clear. What then are the benefits to the Hawaiian and larger Indigenous communities?

**Importance to the Community**

After completing my pilot study for my Plan A Master’s Thesis, I had the opportunity to discuss my research interest with various members of the Native Hawaiian community as well as members of other Indigenous communities. The non-participating members of the Hawaiian community with whom I have spoken recognize the value of this research
project and pushed me to continue. Additionally, being able to contribute and enhance the value of this project was a main reason for the each of the participants to be involved. Each participant recognized the impact their experiences can have on curriculum design and counseling techniques for, by, and with Native Hawaiian students interested in STEM-related areas.

The value, as explained to me by both colleagues and participants in this study, is the recognition that there is no singular “Hawaiian experience” or “Hawaiian identity” for members of the Hawaiian community as a whole, let alone Native Hawaiian members of the science community.

Exploring different “Hawaiian experiences” required the support and participation of multiple members of the science community in Hawai‘i who are of Native Hawaiian ancestry. The diverse group of individuals in this project shed light on both the variety of and connections between their experiences, motivations, and challenges they have faced on a daily basis as they have navigated between their membership in the Native Hawaiian community and their role as a member of the science community.

A project such as this also requires us to unfasten our assumptions and presumptions of both “Hawaiian” and “scientist” identities. The premise of this research project is that this process can and should be done in partnership with individuals who experience these realities—Native Hawaiian members of the science community. This process will give us a clearer picture of what it means to be both “Hawaiian” and a “scientist.” It will also shed light on how these dimensions of identity interact and intersect with each other and how individuals navigate their lives in relation to these identities including, but not limited to their, struggles, influences, and successes. Do these individuals have heroic
tales of how they overcame insurmountable odds? Have they struggled throughout their careers and personal lives to maintain a certain level of worldview stability and self-esteem? Or have they, as Lee (2007) puts it, “led an interesting or beautiful life in science” (pp. 262-281)?

To foster growth and increase the strength of any community, we must acknowledge and celebrate not only the existence of multiple dimensions of identity but a reality in which these multiple dimensions exist in the same space and at the same time. “Power is not an institution, and not a structure; neither is it a certain strength we are endowed with; it is the name that one attributes to a complex strategical (sic) situation in a particular society” (Foucault 1988). Repeating assumptions regarding any dimension of identity only legitimizes the power structure that dominates it. Ethical conversations regarding identity must begin by unfastening such assumptions while creating a new identity paradigm that allows for the existence of multiple dimensions of identity and the fluid nature of identity salience.

Kuhn (1996) questions these assumptions when he asks “can very much depend on a definition of ‘science’? Can a definition tell a man whether he is a scientist or not?” (p. 160). Following this, he asks, “if science is the constellation of facts, theories, and methods…then scientists are the men (sic) who, successfully or not, have striven to contribute…to that particular constellation” (Kuhn 1996, 161). If, however, scientists, are individuals who try to find solutions to puzzles, desire to be useful, get excited at the idea of exploring new territory, and strive to test established knowledge, then our concept of who can be a scientist shifts and widens to accept a larger segment of the population. Kuhn asks us to (re)consider the definitions of both ‘science’ and ‘scientist’ by asking if
an ‘artist’ is overly concerned with being called an artist or with the historicized meanings and assumptions that come pre-packaged by being an artist. In fact, Foucault’s (1980) lamentation that “art has become something which is only related to objects, and not to individuals, or to life” (122) can not only be applied to the state of science during and following the Enlightenment, but also the state of the identity of the “scientist” when he comments, “that art is something that is specialized or which is done by experts who are artists” (350).

Gee (2005) notes that, “we can point out that who(s) and what(s) are not really discrete and separable. You are who you are partly through what you are doing and what you are doing is partly recognized for what it is by who is doing it” (p. 14). Ethically considering who an individual is requires us to consider not just a singular what but all of the what(s) that determine the who. As such, in order to begin having a conversation regarding “Hawaiian” and “scientist” identities we need to cast aside Enlightenment era and neo-positivist assumptions and presumptions for these and all identities that make up an individual. Instead we should consider both the overall identity and the dimensions that create it as robust, complex, and fluid rather than singular and static. We should also (re)consider individuals life experiences within each of their dimensions of identity rather than assuming that their experiences may be based on the presumptions by Enlightenment’s wake (Gray 2007).

The unique life experiences expressed through this project help us move beyond Enlightenment-era and neo-positivist assumptions of individuals’ reality and shed light on the interplay between different dimensions of identity, specifically being “Hawaiian” and a “scientist.” In this same vein, Foucault (1980) notes that, “if we are asked to relate
to the question of identity, it has to be an identity to our unique selves. But the relationships we have to have with ourselves are not ones of identity, rather they must be relationships of differentiation, of creation, of innovation. To be the same is really boring” (p. 385).

This research project with Native Hawaiian members of the science community aims to contribute to a better understanding of issues relating to equity in science education. It also looks to improve science curriculum to support Native Hawaiian students as well as enhance support systems for Native Hawaiian students interested in pursuing higher education and science-based careers. Additionally, this research gives a voice to individuals so they can share their inspirations and influences as well as the biases, prejudices, and judgments they encountered from both the Native Hawaiian and scientific communities.

This project has presented opportunities for me and the participants to explore aspects of the decolonization process as explored by Laenui (2000) and Wilson and Bird (2005) such as rediscovery/recovery, mourning, and dreaming by combining types of indigenous research outlined by Smith (2004). These include, but are not limited to, (re)claiming\textsuperscript{12}, indigenizing\textsuperscript{13}, envisioning\textsuperscript{14}, story telling\textsuperscript{15}, (re)framing\textsuperscript{16}, (re)naming\textsuperscript{17}, protecting\textsuperscript{18}, and discovering\textsuperscript{19}. As such, it is important to acknowledge and explore the impact colonization has had on Hawaiian culture and the effect it has had on this project and the lives of the individual narrators.

\textbf{The Impact of Colonization}

Decolonization processes are most often used in reference to members of indigenous populations. However, they can also be applied to other dimensions of identity including gender, sexuality, dis(ability), and socioeconomic status. The connective thread for each
of these dimensions of identity as Kaiser (2011) notes “was the decision...to reject the submissive roles white men had reserved for them (and has) legitimized the aspirations of every other victim of oppression.” That being said, each individuals’ reality within dimensions of identity such as, “Hawaiian,” “female,” or “homosexual” is unique, especially in terms of their intersection and interaction with the panoply of identities they have also fastened to themselves. Moreover, when these unchosen (natural) identities are combined with chosen identities (i.e. scientist) we are presented with very unique perspectives.

According to scholars such as Denzin, Lincoln, and Smith (2008), Laenui (2000), Smith (2004), Wilson (2008), and Wilson and Bird (2005) understanding the “Native perspective” requires looking at the two factors that have shaped and developed Indigenous culture over thousands of years. The first framework that has and continues to shape the Native perspective is the ecology of the culture—the relationship between Native Peoples and the land on which they live. The second framework, as Smith (2004) remarks is imperialism. Imperialism and colonialism “is part of our story, our version of modernity” (p. 19). The process of “colonization refers to both the formal and informal methods (behaviors, ideologies, institutions, policies, and economies) that maintain the subjugation or exploitation of Indigenous Peoples, lands, and resources” (Wilson and Bird 2005). The first involves the formation and evolution of groups of people through thousands of years of language, culture and history. The second is an “interruption and radical reformulation by European” (Smith 2004) and later American imperialism and colonialism.
Kanaka\textsuperscript{22} Maoli like other groups around the world, created culture as a way to buffer themselves against this anxiety. Kawagley (1998) notes that Indigenous values include “sharing”, “cooperation”, “respect for the wisdom of elders”, and “extended family” (p. 138). These values are centered on survival. A tribe who shared resources, cooperated in both plentiful and scarce times, and heeded the wisdom of elders was more likely to survive. Additionally, the concept of an “extended family” not only helped to prevent physical death it also prevented emotional and spiritual death through knowledge of your bloodline. The traditions, myths, legends, ceremonies, stories and lessons that guide members of the Indigenous communities were formed over thousands of years of interaction with their environment. Knowledge meant the difference between life and death. “A hallmark of…Native peoples was their success at adapting to ever changing environmental conditions…reconstruct(ing) and continuously modify(ing) their worldviews, so that ‘new’ Native traditions have evolved even up to the present day” (Kawagely 1998, 139-140).

To gain the knowledge needed to survive, Hawaiians became keen observers of their environment. Hawaiian “knowledge is consensual, replicable, generalizable, incorporating, and to some extent experimental and predictative” (Kawagley 1998, 134). Similar to the so-called Western scientific method, Native peoples specialized in “observing and reading the sign-makers of nature” and made predictions “based on observable phenomena” (135). Unlike the scientific method, Hawaiian ways of knowing did not attempt to separate the observer from their surroundings (Collingwood 1960). Natural laws, the knowledge gained from them, and the language used to describe them are not to be understood and controlled (Foucault 1972, Gee 2005). Instead “natural laws
are placed in the universe to guide human beings’ thoughts and actions” (Kawagley, Norris-Tull, and Norris-Tull 1995). “The (Native) worldview is based on an alliance and alignment of elements and that there must be constant communication between the (Natural, Spiritual, and Human) realms to maintain this delicate balance” (Kawagley 2006, 14-15).

If the traditional Hawaiian worldview represented balance and harmony, then the modern framework used to analyze the Native perspective is the antithesis. Imperialism and colonialism have come to define the modern Hawaiian perspective, just as it defines the perspective of so many other Indigenous peoples. This topic is “embedded in our political discourses, our humour (sic), poetry, music, story telling, and other common sense ways of passing on both a narrative history and an attitude about history” (Smith 2004, 19). The process of colonization and subjugation that still haunts the Indigenous psyche includes, as Laenui (2000) notes, denial/withdrawal, destruction/eradication, denigration/belittlement/insult, surface accommodation/tokenism. The pain of imperialism and colonialism are still being felt in Native communities throughout the world. Their struggle for survival is part of living history. Their cultural, spiritual, metaphysical, psychosocial, and resulting physical trauma is real and current. “The encroachment of Western civilization in the (Hawaiian) world changed a people that did not seek changing” (Kawagley 2006, 47).

**The Impact of Contact on Ancient Hawaiian Culture and Society**

When Captain James Cook arrived in Hawai‘i in 1778, he came upon a culture and cultural worldview that had existed and evolved independently of his. While similarities existed between Hawaiian culture and other Polynesian cultures throughout the Pacific, the culture that was in Hawai‘i was unique to Hawai‘i. Ancient Hawaiian culture was
based on a rigid kapu system that was, on the one hand, hierarchical with clear separation between ali‘i, mō‘ī, and maka‘āinana. On the other hand, it was also incredibly inter-relational with status being determined through a variety of means including bloodline, occupation, knowledge, and gender. “The impact of in-migrating (British and American) cultures arriving in the traditional lands of the Maoli people has required from them a marked degree of change and adaptation” (Cook et al. 2005, 10). The anxiety buffer that their culture had provided for thousands of years was quickly and efficiently dismantled through disease, social and religious conversion and constant threats to sovereignty (Cook, Withy, and Tarallo-Jensen 2003, Salzman 2001, Salzman 2004, Solomon, Greenberg, and Pyszczynski 1991).

Like so many other Indigenous cultures, the Kanaka Maoli were “sufficiently content with their lifestyle that they did not readily accept Western education and religions when the first envoys…set foot in their land” (Kawagley 1999, 11). Unknowable, incurable and incomprehensible diseases decimated the Hawaiian people. Villages were wiped out. Elders and shaman died despite their traditional and spiritual beliefs. Traditional language, knowledge, and practice was marginalized, ridiculed, and “condemned to the prehistory of error, prejudice, or imagination” (Foucault 1972, 184) of the Hawaiian people. The Hawaiian buffer system, developed through thousands of year of tradition, fell apart despite “remarkable efforts and history of cultural resilience and resistance to assimilation” (Silva 2004, 1) by the ali‘i, kaukauali‘i, and maka‘āinana. Thiong‘o (1986) refers to this as the “cultural bomb.” The effect of which “is to annihilate a people’s belief in their names, in their languages, in their environment, in their heritage of struggle, in their unity, in their capacities and ultimately in themselves” (3). The
resulting anxiety of this bomb propelled “surviving” Kanaka Maoli into the awaiting arms of missionary, government and education officials.

By the mid-1800’s, after having lost their own standards of self-worth, “the mō‘i and ali‘i were engaged in a search for sovereignty in Euro-American terms” (Merry 2000, 36) socially, religiously, legally, psychologically and educationally (Cook, Withy, and Tarallo-Jensen 2003, Cook et al. 2005, Kauanui 2008, Tengan 2008). Hawaiian cultural, ideology, and “language was disparaged as inadequate to the task of ‘progress’” (Silva 2004, 2-3). The Organic Acts, 1839 Declaration of Rights, the Masters and Servants Act, and the 1840 Constitution, with supplemental laws passed between 1840 and 1842 attempted to balance modernity with “significant amounts of Hawaiian customary law and practice” (Merry 2000, 79). The Organic Acts, for example, separated executive and judicial powers and eliminated the powers of the king over judicial matters except as chief judge of the Supreme Court. These acts contained “no significant provision for customary law, for native courts, or for a dual system of law” (ibid). Symbols, values and the laws that draw from them are culturally specific.

Hawaiians and Christians, drawing from different cultures, interpreted the new laws differently. Throughout the 1800’s, missionaries attributed the failure of conversion to “the cognitive deficiencies of the Hawaiians and their inability to think abstractly” (ibid). As the number of foreigners arriving in Hawai‘i increased, so did clashes between traditional Hawaiian values and practices and modern economic needs and desires. These clashes culminated in the 1848 Mahele, granting land ownership rights to non-Native residents of Hawai‘i; the 1887 Bayonet Constitution, stripping the monarchy of power and alienating the majority of the Kanaka Maoli population in favor of American,
European and Hawaiian elite interests; and finally the overthrow of the monarchy in 1893, establishing the Republic of Hawai‘i in preparation for annexation by the United States.

Missionaries steered Hawaiians away from the spiritual and metaphysical heritage of their ancestors. The importance of traditional knowledge, practices, myths and legends were trivialized and demonized. Local, state and government officials set up grants and assistance for everything from electricity to housing assistance. This “effectively relieved villagers of their self-esteem, self-reliance, self-sufficiency, and self-determination” (Kawagley 2006, 70). Governments also set up fishing and hunting schedules as well as limits on the kinds and amounts of fish/game a person could catch/hunt. Schools were established to teach children English along with new knowledge and skills. “Compulsory School Attendance Laws were enacted, requiring families to remain in one location for many months of the year, thus ending the Native peoples’ practice of moving from place to place according to the seasons” (48).

Schools, therefore, became models of “bureaucratic punctuality and precision” in which “each pupil must be taught first and foremost to conform his behavior to a general (European/American) standard” (Tyack 1974, 43).

This assimilationist attitude combined with Protestant theology and the widespread acceptance of the savage-to-civilization (Social Darwinism) viewpoint to generate the educational policy used in Hawai‘i at this time. “These factors formed a mutually reinforcing system with public education as the primary vehicle used to assimilate those who were perceived as different” (Benham and Heck 1998, 9). Hawaiians were different, and it was the goal of education in Hawai‘i to “Americanize” Native Hawaiian students.
In 1893, public and private schools taught in the Hawaiian language were outlawed and English became the only acceptable language for business, education, and government in Hawai‘i. Adams (1995) explains the educational strategy regarding native education:

“The first priority was to provide the [Hawaiian] child with the rudiments of an academic education, including the ability to read, write and speak the English language. Beyond language instruction, [Hawaiian] schools...introduce[d] the child to the civilized branches of knowledge – arithmetic, science, history and the arts – not with the idea that he would master these areas, but that he might ‘catch a glimpse of the civilized world through books’” (21).

Indigenous students were taught that what was written in English counted more than the stories told at home in a Native language. And “when stories at home do not match up with the texts at school, students are taught to doubt the oral versions” (Silva 2004, 3). After all, “when stories can be (shared and) validated…and made available to the community, people begin to recover from the wounds caused by that disjuncture in their consciousness” (ibid).

“To say that educational policy alone impacted negatively on Native Hawaiians’ academic, economic, and social standing would be naïve; however, the public schools played an integral role” (Benham and Heck 1998, 111). Social and educational policies in Hawai‘i mirrored commonly held beliefs within the United States and Europe, namely individualism, economic self-sufficiency, hard work, moral uprightness, citizenship and allegiance to Euro-American style government (Benham and Heck 1998, Kliebard 1995, Merry 2000, Tyack 1974). While the Euro-American system brought new knowledge and had the potential to add to the Hawaiian view of the world, “there were fundamental differences...that were never reconciled, conflicting values [that] created an atmosphere pitting the new against the traditional” (Benham and Heck 1998, 111-112). Hawaiians embraced the interconnected nature of their culture that made everything around them sacred and part of the larger Hawaiian community. The dominant anti-Hawaiian attitude,
with its focus on Enlightenment-era scientific objectivity, severed these connections and left many Hawaiians adrift without their traditional anxiety buffer. “The worldview was shattered and invalidated and, in TMT terms, anxiety-buffering self-esteem was inaccessible; anxiety related behaviors” (Salzman 2004, 235) including smoking, physical, sexual and substance abuse increased dramatically and continue to be among the highest of any ethnic group in Hawai‘i.

Having assumed political control of Hawai‘i through the overthrow and annexation in 1893 and 1898 respectively, Native Hawaiians “have contended with a dominant society’s hegemonic agendas imposed on their culture and daily lives” (Jester 2002, 1). The colonial/imperial approach to schooling imposed upon the Native Hawaiian population in the 19th century has continued well into the 20th century and has formed the foundation of the modern Hawai‘i public educational system. This system, like those that serve Native Alaskans (Jester 2002), Indigenous Australians (De Souza 2007) and Native Americans (Apthorp, D'Amato, and Richardson June 2003, Corbiere 2000), has “consistently failed to provide [Hawaiians] a culturally relevant educational experience” (Jester 2002, 2).

**Modern Efforts at Reform and Oppression**

Efforts have been made to create culturally responsive curriculum and establish Hawaiian language and culture immersion schools. In 2002 the Native Hawaiian Education Council (NHEC) in partnership with Ka Haka ‘Ula O Keʻelikolani and the College of Hawaiian Language at the University of Hawaiʻi at Hilo developed a handbook for schools, families, educators and students that provided guidelines for culturally healthy and responsive learning environments. This manual mirrors a similar effort by the Assembly of Alaska Native Educators and their Alaska Standards for
Culturally-Responsive Schools created in 1998. The 2002 manual, referred to a Nā Honua Mauli Ola, was developed “with the belief that continued learning and practicing of the Hawaiian language and culture is a fundamental prerequisite for nurturing culturally healthy and responsive citizens and contributes to the growth and harmony of the community” (2002, 13). These efforts, and others like it, were made as part of a demand for recognition in response the identity disregard inflicted upon the Hawaiian population through English and American colonization. As Gutman (1994) notes, “The demand for recognition…points in at least two directions, both to the protection of the basic rights of individuals as human beings and to the acknowledgement of the particular needs of individuals as members of specific cultural groups” (Taylor 1994, 8).

While strides were being made to address indigenous cultural acknowledgement in Hawai‘i’s curriculum, other forces were at work to limit the reach of curricular multiculturalism. Today’s educators are familiar with No Child Left Behind (NCLB) and its strict adherence to standardized test scores as the primary measure of student success. In reality, the modern standards-based movement began much earlier. “Many educators see the publication of the now famous report, A Nation at Risk, as the initiating event of the modern standards movement” (Marzano 1997, 37). Following the publication of this report, the rhetoric of educational policy changed drastically in favor of links between our educational systems and the financial security and economic competitiveness of the United States as a whole. This link continues to be cited by government officials, economic advisors and political leaders.

Additionally, many in America have felt that “core values” are being threatened from within and without. The social and cultural revolution during the 1960’s and 1970’s saw
active social, cultural, and political participation of previously marginalized groups within the fabric of American society including, but not limited to, women, Blacks/African-Americans, and gays. In Hawai‘i, these years marked the beginning of the Hawaiian renaissance that included the renewed interest in Hawaiian culture, practice and values. A variety of organizations were founded during this time to support this cultural (re)birth including the Merrie Monarch Festival (hula), the first Hawaiian language immersion schools (language), the Polynesian Voyaging Society (traditional cultural and religious practices), and the Protect Kaho‘olawe ‘Ohana (land reclamation).

A perceived change in the social and cultural makeup of the United States, including Hawai‘i, generated the possibility of a more multicultural worldview that some in power may not have been comfortable with. Self-esteem, both individual and collective, can be understood as a sense of personal value. Self esteem, according to Solomon (1991) “consists of two components: (a) faith in the cultural worldview and acceptance of the standards of value inherent in that worldview; and (b) the perception that one is meeting those standards of value and therefore has a significant role in the cultural conception of reality” (106). Educational policies that favored “multiculturalism, globalism, and interethnic understanding and reconciliation” (Forbes 2000, 1) threatened the power structure dominated by Christian, White males of European descent. “In fact, one can clearly see a very strong xenophobic movement that is very reminiscent of the assimilationist hysteria” (ibid).

“Part of this reaction against multiculturalism and bilingualism is reflected in the rapid push for so-called ‘standards’ in the schools” (Forbes 2000, 1). At an Education Summit in 1989 between President George H.W. Bush and the nation’s governors,
including then-governor Bill Clinton, six broad goals for education were decided upon and should be have been reached by the year 2000. These goals included general guidelines regarding competency levels in subjects including English, mathematics, science, history and geography as well as a declaration that “by the year 2000, U.S. students will be first in the world in science and mathematics achievement” (Marzano 1997, 5). Following the summit a variety of subject related educational organizations including the National Council of Teachers of Mathematics (NCTM), the National Science Teachers Association (NSTA), and the American Association for the Advancement of Science (AAAS) quickly launched independent attempts to identify standards in mathematics and science. This was followed by efforts in the fields of theater, music, art, language arts, civics and social studies.

Despite auspicious beginnings, the standards movement had trouble gaining traction. Although both state and national standards have been drafted and reformulated for almost the past twenty years, it was not until the passage of the Federal No Child Left Behind (NCLB) Act in 2001 that gave standards the amount of weight they enjoy today. NCLB’s focus on rigorous and frequent standardized testing with consequences to schools failing to meet mandated criteria refocused the need for standards as well as the debate. The new Common Core State Standards (CCSS) continues this tradition by establishing nationwide standards of achievement. Thus students in Hawai‘i will be expected to learn the same content at the same rate as their grade level peers in California, Texas, and New York.

Wagner (2008) notes how “the fact that schools and districts are now being held accountable at all—and accountable for the success of all their students—is a new and
very important concept in public education” (89). On the one hand, some felt that having standards from which all schools in a given state will operate would create a more efficient educational system. This sentiment harkens back to the “factory model” of the 1800s. On the other hand, there has been consistent and lively debate regarding the rationale for standards and the content that will be taught.

Marzano and Kendall (1996) note that one of the factors for the failure of standards to catch on during the 1980s and 1990s was that some believed standards to be a new attempt at previous failed reforms. Previous educational policy had been for the eradication of Indigenous culture and the indoctrination of Native children (Adams 1995, Apthorp, D'Amato, and Richardson June 2003, Benham and Heck 1998, Corbiere 2000, Jester 2002). Lately, however, efforts have been made to create educational systems and methods that were culturally relevant to encourage and support students from previously marginalized communities. However, in order to have a plural and multicultural society the value of other cultures must be acknowledged. Acknowledging the value of a different, possibly opposing worldview, threatens collective anxiety buffers. How can two ways of knowing be the right way? “There is reason to believe that the push for ‘standards’ is actually an attempt to destroy multiculturalism, pluralism and non-Anglo ethnic-specific curriculum by forcing all public schools to adhere to a curriculum approved by centralized agencies controlled by white people” (Forbes 2000, 1-2).

While “we [must] recognize that opposing worldviews do not necessarily imply mutually exclusive cultural worldviews” (Walsh and Smith 2007, 104), there “are cases in which groups are justified in seeking public support to maintain subcultural identity” (Feinberg 1998, 28) and the recognition of “different systems” (Meyer 1998b, 27). The
current system of standards and nationally generated standardized tests imply a specific and preferred social, cultural and psychological identity and worldview. To effectively measure progress between states, “such tests would, of course, have to be the same in Mississippi and in Hawaii or Alaska, states with vastly different cultural traditions and social values” (Forbes 2000, 3). Uniform testing is a form of collectivization. If your identity differs from those that are on a test, you could be more likely to fail. If your school serves a population whose collective identity differs from that on the test, your school could fail. Forbes (2000) describes the pitfalls of nationalized tests this way:

“California and other western states will suffer more than most from nationalization because the east coast is typified by a long tradition of upper-class elitism and white dominance modified by an awareness of African-Americans being present as an ‘issue.’ Thus one finds that east coast people tend to be often obsessed by Black-white relations while being supremely ignorant of the Puerto Ricans, Native Americans and other groups in their region” (8-9).

Given Hawai‘i’s multicultural and multiethnic make-up, the idea of one test to fit all students seems laughable to the point of being ridiculous. Forbes (2000) goes on to explain how “tests, standards, and texts written by east coasters are apt to be completely unsuitable for use in California, Arizona, New Mexico, Texas, Oklahoma, Alaska, Washington, Hawaii (sic) and other western/southwestern states” (4).

Attempts to make curriculum multicultural with utilization of place and native ways of knowing has met with resistance. Lynne V. Cheney, a fellow at the American Enterprise Institute, unleashed an attack upon history standards in the fall of 1994. “Cheney accused the history standards of portraying the United States and its white, male-dominated power structure as an oppressive society that victimizes minorities and women” (Marzano 1997). The outrage expressed by Lynne Cheney is a reactionary expression of a perceived threat to the ideological norms that buffer her anxiety. Cheney
sits atop a white dominated cultural hierarchy. That hierarchy, and the power she enjoys by being part of it, will be vigorously defended against any perceived threat. Although his book *Whose America?* (2002) focuses on issues pertaining to “White curriculum” versus “Black/African-American” curriculum, the issues Zimmerman raises surrounding cultural inclusion/exclusion in today’s curriculum is pertinent to Indigenous children in both Hawai‘i and the Continental United States. “The neglect of [Native] subject matter must be seen within the context in which most Native children and their communities live. Indigenous children are generally not like European children who have experienced no racial denigration or denial of their right to be themselves” (Forbes 2000, 18).

“Cultural, linguistic and economic marginalization are factors” (Chinn 2007a, 1249) that resulted in cultural and psychological trauma that many Euro-Americans, thankfully, have not had to experience.

Tests and standards implemented across the country will need to take into account the social, cultural, and ideological norms of that area. The first iterations of the Hawai‘i Content and Performance Standards (HCPS) contained separate Hawaiian cultural standards to be implemented along side math, science and language arts. Those standards have since disappeared from later versions of Hawai‘i’s standards and are never mentioned in relation to No Child Left Behind (NCLB) or Common Core State Standards (CCSS) (Howe 1997).

Just as the Hawaiian identity is an evolving one today, contributed to by (re)discovery of Hawaiian cultural practices and beliefs as well as the diverse cultural beliefs and practices found in modern Hawai‘i, curriculum based on Hawaiian culture and values have evolved as well. Curriculum such as “Mālama Kahoʻolawe” and “Aloha ʻĀina”
developed by the Pacific American Foundation is now aligned to HCPS. Standardized tests and texts aim to “objectively” measure academic achievement. To the Native Hawaiian learner “standardized education culminates in a detachment-perhaps displacement-of our Native identity, because our identity is based on the natural world” (Corbiere 2000, 6). Corbiere continues to explain how “a curriculum that emphasizes detached observation and controllable, repeatable experiment-does not necessarily engender conditions” (7) to accurately gauge student achievement, personal growth and progress. The fact that culturally responsive curriculum has had to adapt to include federal and state standards is evidence that Native populations must, once again, seek to define themselves in terms of the dominant Euro-American culture.

**Health Status**

While there is no direct evidence linking colonization and the health status of Native Hawaiians, the physical, emotional, and mental health of Native Hawaiians is among the worst in Hawai‘i and, in some cases, the country. Native Hawaiians have rates of type-2 diabetes four times higher than the U.S. standard population with mortality rates eight times that of non-Hawaiians. Mortality rates for all cancers combined are second in the nation (to African Americans among males and to Alaska Natives among females). Native Hawaiians have twice the rate of asthma as other ethnic groups and, not surprisingly, the shortest life expectancy in the State of Hawai‘i. In fact, while the health statistics for other ethnic groups were improving from 1980 to 2010, the statistics for Native Hawaiians were worsening. Data indicates that Native Hawaiians suffer some of the worst health inequities including being five times as likely to experience diabetes between the ages of 19-35 and have the highest rates of deaths due to cancer compared to
any other ethnic group in Hawai‘i (CDC 2013, OHA 2011). Smoking rates are 50 percent higher than other groups and rates of obesity and overweight status (75.5 percent) are the highest in the state (Kana‘iaupuni and Ishibashi 2003). Native Hawaiians, like many other Indigenous populations, also have the highest rates of heavy alcohol, marijuana, and heroine usage in the state (Brave Heart 1999, Cook, Withy, and Tarallo-Jensen 2003, McCubbin, Ishikawa, and McCubbin 2008, Salzman 2004, Whitbeck 2004).

**Academic Status**
Native Hawaiians, like other minorities, are severely under-represented in high education and in science, technology, engineering, and math (STEM) related careers (National Science Foundation 2013) despite research, modification of instructional practices, and curriculum development. At the University of Hawai‘i at Mānoa (2010) there are currently 1,994 (14.3 percent) undergraduate and 728 (11.4 percent) graduate students enrolled who identify themselves as Hawaiian or Part-Hawaiian. Additional statistics regarding Native Hawaiian students in school are staggering. While Native Hawaiians make up approximately 23 percent of the state’s general population, 79 percent of predominantly Hawaiian public schools are in some form of corrective action. Standardized test scores of Hawaiian students are the lowest among all major ethnic groups, consistently lagging behind total DOE averages by at least nine percentiles. Hawaiian students are overrepresented in the special education system with more than eighteen percent of Hawaiian students classified as requiring special education compared to eleven percent of non-Hawaiians. The graduation rates of Hawaiian students are among the lowest in the DOE, sixty-three percent in 2010, and grade retention rates among the highest with one out of five students being held back. Hawaiian adolescents
have the highest rates of juvenile arrest (40.5 percent of the 1,250 juvenile arrests in 2011), are more likely than their non-Hawaiian counterparts to use drugs (12.6 percent of Hawaiians had used some type of drug by the 6th grade, compared to 8.3 percent statewide) with 60 percent of Native Hawaiian youth having a lifetime prevalence of any illicit drug, and engage in early sexual activity with 11 percent reporting having sexual intercourse before age thirteen (CDC 2013, Cook, Withy, and Tarallo-Jensen 2003, Kana‘iaupuni and Ishibashi 2003, Kana‘iaupuni, Malone, and Ishibashi 2005, OHA 2011, Okamura 2008).

**Bridging the Divide**
Research with Native Hawaiian members of the science community is necessary to contribute to a better understanding of issues relating to equity in science, science education, and towards improving science curriculum to support Native Hawaiian students as well as support systems for Native Hawaiian students interested in pursuing higher education and science-related careers. Additionally, this project gives voice to individuals so they can share their inspirations and influences in becoming scientists as well as the bias, prejudices and judgments they encountered from both the Native Hawaiian and scientific communities. Many Hawaiian men and women are attempting to bridge the divide between Hawaiian and Western worldviews. However, “it is difficult to try to live in two worlds without adequate bridges between them” (Kawagley 2006, 50). Since the Hawaiian renaissance of the 1970s and 1980s, Hawaiians students and adults alike have been (re)discovering their heritage, language, and culture.

Both Laenui (2000) and Wilson (2005) refer to this process as decolonization. To aid in this rediscovery members of the Indigenous community are participating in what Freire (1998, 2000) as *praxis*-reflection and action upon the world in order to transform it. This
includes giving name to the general and personal experience of colonization, questioning
the legitimacy of colonization, and accepting the premise of colonization as ways to
actively work towards freedom and to transform lives and the world (Wilson and Bird
2005). This process begins in the individuals’ mind. To aid in this process members of
the Native Hawaiian community are providing their voices and experiences to this
particular worldwide worldview conversation (McCubbin, Ishikawa, and McCubbin
2008). Is there one Hawaiian voice? Is there a singular Hawaiian experience? These are
questions that will be explored and answered as Native communities around the world
(re)discover and (re)build their communities.

Colonization and the subsequent cultural, educational, political, economic subjugation
of the indigenous people of Hawai‘i had a substantial impact upon the physical, social,
and psychological Hawaiian identity both individually and collectively. The effects, as
noted earlier, are still being felt today and manifest itself in a variety of abuses, elevated
crime rate, and poverty. Does the sociocultural history of the Hawaiian people impact
individual identity formation and salience? How do individuals reconcile and navigate
the demands of their cultural and professional identities?
CHAPTER 2. LITERATURE REVIEW

“Conversations across boundaries of identity – whether national, religious, or something else – begin with the sort of imaginative engagement you get when you read a novel or watch a movie or attend to a work of art that speaks from some place other than your own” (Appiah 2006, 52-53).

Identity theorists such as Amartya Sen (Sen 2006), Kwame Appiah (Appiah 2006, 2007), and Andrew Solomon (Solomon 2012) ask us to consider the ramifications of shifting the identity paradigm away from singular identification to one acknowledging plurality. Their challenge seeks to create identity connections across cultures and throughout humanity instead of creating artificial compartments of individual identities. This literature review will present research that examines some of the broad issues introduced in Chapter 1 relating to identity. These issues include theories of identity and identity salience. This review will also survey research into the relationships between the “chosen” science identity and other “unchosen” identities such as gender, sexuality, and ethnicity. The findings of this literature review reveal that the broad examination of various facets of identity is not a new research concept. However, it will also show how this research project with Native Hawaiian members of the science community fits into and expands this particular body of knowledge.

Chapter 2 will examine literature about the relevance of identity research involving relationships and the potential complements and conflicts between the “scientist” and “Hawaiian” identities. There are five (5) main sections in Chapter 2 including: 1) a survey of Identity Theory, to provide a context for understanding competing and complementary theories of identity, how identity is formed and why, and to establish a case for continued research in the area of identity; 2) an exploration of research seeking to reconceptualize the model of identity to accommodate multiple identities; 3) a survey
of Identity Salience research which will provide context to support research in to the 
exploration of multiple identities and the potential impact on complementary/contrasting 
identities; 4) an exploration of science-related ethnic/cultural-based identity studies, 
models, case studies that inform the theoretical framework for this study and a critical 
overview of science education by/for/with Indigenous Peoples to support the need for 
continued research; and, 5) a review of scholarly work with regards to minority and 
underrepresented groups and their experiences in higher education with particular focus 
on first-generation students.

**Identity – Who am I?**

Each of us, at one or several points in our lives, has taken stock of ourselves and 
asked, “Who am I?” The question invites reflection on the complex nature of our identity 
and awareness that while we are an amalgam of identities we are greater than the sum of 
our parts. This becomes especially apparent as we examine what Sen (2006) refers to as 
chosen/unchosen identities, reflect on how we have changed over the years, and postulate 
on what our identity(ies) may be in the future. Lately, the concept of pluralistic identity 
has become a rich source of research material for those in the fields such as psychology, 
sociology, anthropology, and education. As Taylor (1994) explains, “the (post)modern 
notion of identity has given rise to a politics of difference” (38). Rather than recognizing 
universal similarities within society (i.e. human, American) with an identical system of 
laws, rights, freedoms the particular groups are demanding their unique identities be 
recognized. Everyone should be recognized for his or her unique identity(ies) (i.e. 
African-American, Gay/Lesbian, Republican) and it is “this distinctness that has been 
ignored, glossed over, assimilated to a dominant or majority identity” (ibid) that is 
driving much of current identity research.
Researchers see the increase in identity research as a response to the hierarchical post-positivist research (Stryker and Burke 2000) of the past and as a “way to transcend the societal tendency to compartmentalize everything including the self” (Stewart 2008, 184). As we emerge from the positivist and reductionist “Enlightenment Project” (Gray 2007), researchers are looking for more internal self-defintions and away from singularist, externally imposed definitions of identity. The paradigm shift raises important issues including the method(s) used to define identity, how we obtain identities, and how we break through and navigate “externally imposed limitations to internalized, interlocking components through which self-actualization or...self-conscious personhood, may be fully realized” (Stewart 2008, 184).

Stryker and Burke (2000) explains that “the language of ‘identity’ is ubiquitous in contemporary social science” however, “the common usage belies the considerable variability in both its conceptual meanings and its theoretical role” (284). The term identity falls in to three distinct and consistent usages: 1) identity is used to refer to the culture of a people with no distinction drawn between, for example, identity and ethnicity; 2) identity is used as identification within a collectivity or social category; and, 3) identity is used to refer to parts of a self composed of the meanings that persons attach to multiple “selves” or roles they typically play in a highly differentiated society. This final meaning and theoretical role of “identity” has developed from research in to symbolic interactionism and is a belief shared by those who recognize the complexity of contemporary society.

**Symbolic Interactionism**

Terror Management Theory (TMT) posits that culture is created to act as an anxiety buffer against both real and symbolic death. “Humanly created symbolic perceptual
constructions shared by groups of people to minimize the anxiety associated with the awareness of death. [Culture] imbues the world with meaning, order, stability and permanence, and by doing so, buffers the anxiety that results from living in a terrifying and largely uncontrollable universe” (Solomon, Greenberg, and Pyszczynski 1991, 96). Accordingly, cultural groups create complex systems involving language, symbols, and norms that extend beyond the self to a social and existential level. “Feeling that one is a part of something larger and significant is often fulfilled by group identification” (Walsh and Smith 2007).

*Symbolic Interactionism*, derived from the work of George Herbert Mead, Charles Cooley, and Herbert Blumer, is the sociological perspective that emphasizes the actions people have towards things based on the meaning those things have for them (Burke 1980, Hogg and Terry 2000, Stryker 1968, Stryker and Serpe 1994, Stryker and Burke 2000). “These meanings are derived from social interaction with members of a particular group and/or society as a whole and then modified through interpretation by the person dealing with things s/he encounters” (Blumer 1969, 66). How an individual defines, interprets and reacts to a symbol depends on the cultural significance of that symbol which is part of the group and individual anxiety buffer. Colors, images, animals, plants, and geographic locations may be significant to different cultures but for different reasons and can result in both real and existential conflict and trauma (Arndt 1998, Brewer and Gardner 1996, Salzman 2001, Solomon, Greenberg, and Pyszczynski 1991). For example, conflict between Native Hawaiians and the United State military over the use of the island of Kaho‘olawe came to a head in the 1970’s. On the one hand, was a group who valued the land as the physical embodiment of the deity Kanaloa and the piko26 of
the Hawaiian Islands. On the other, was a group who valued the land as an essential part
of the nation’s military strategy to keep its citizens safe. Although both groups place
value on this particular geographic area, the symbolic meanings differ and conflict with
one another. As was discussed in Chapter 1, this real and existential conflict is consistent
with the colonization and marginalization of the Hawaiian people and, as we shall see in
Chapter 3, is a theme and tenet of Indigenous research and methodology.

**Identity Theory**

*Identity Theory* (Stryker 1968, Stryker and Statham 1985, Stryker and Serpe 1994,
Stryker and Burke 2000), was born out of the framework of symbolic interactionism, and
has the goal to understand and explain how social structures affect self and how self
affects social structures (Burke 1980, Stets and Burke 2000). Nuttbrock (1991) explains,
“the self (identity) is composed of more or less related ‘multiple selves’” and “identity
theory views self, role, and society as relatively structured and causally interrelated”
(146). This theory attempts to specify and make researchable the concepts of “society”
and “self” in Mead’s framework and to organize these as explanations of specified
behaviors (Stryker 1968). The theory seeks to answer this quintessential question: Given
situations in which there exist behavioral options aligned with two (or more) sets of role
expectations attached to two (or more) positions in networks of social relationships, why
do persons choose one particular course or action? (Stryker and Statham 1985, Stryker
and Burke 2000). Acceptance of this framework implies that the “self” is multifaceted,
fluid, dynamic, and made of interconnecting, interdependent, independent, mutually
conflicting and reinforcing parts (Brewer 1991, Brewer and Gardner 1996, Sen 2006,
Stewart 2008, Stryker and Statham 1985) one is seeking to be and enact here-and-now
(Gee 2001, Gee 2005).
“In identity theory, the core of an identity is the categorization of the self as an occupant of a role, and the incorporation, into the self, of the meanings and expectations associated with that role and its performance” (Stets and Burke 2000, 225). “Stryker proposed that we have distinct components of self, called role identities, for each of the role positions in society that we occupy” (Hogg, Terry, and White 1995, 256). The cognitive process used to establish these roles is referred to as *self-verification* – role identities are self-conceptions, self-referent, and/or self-definitions that we apply to ourselves as consequences of the structure of society and our location within that structure. Role identities provide meaning for self since they refer to a concrete role specification (a wife or mother). They also distinguish roles from relevant complementary or counter roles (a husband or father). More recent research has also drawn upon the meaningful relationship between the individual and the resources necessary to maintain and sustain particular role identities as central components in the identity process (i.e. to be a parent requires a child).

Role identities or self-conception (Hoelter 1983, 1986), also known as *self-categorization* in Social Identity Theory (Burke 1980, Callero 1985, Haslam et al. 1999, Hogg and Terry 2000) and *identification* in Identity Theory (Hogg, Terry, and White 1995, Stets and Burke 2000, Stryker 1968, Stryker and Statham 1985, Stryker and Burke 2000) and propose an internal decision making process within the larger social structure of culture that influences situational behavior. Riley and Burke (1995) note that through a lens of Identity Theory, identity can be viewed as a control system consisting of four parts (see Figure 1).
Riley and Burke go on to explain that,

“Input from the environment, consisting of self-relevant meanings is brought to the comparator along with self-defining meanings from the identity standard. The comparator relates the two sets of meanings. Insofar as they differ, error is present and is felt as a form of discomfort ranging from relatively mild dissatisfaction to severe distress. Output, or meaningful behavior, varies according to the magnitude of the error. This behavior in turn modifies the situation and creates new perceptions of input” (62-63).

Proponents of Identity Theory posit this internal process happens at the sub-conscious level however research into both Psychological Centrality (Gecase 1990, Kiang, Yip, and Fuligni 2008, Kling 1997, Stryker and Serpe 1994) and Discursive Identity (Brown 2004, Brown, Reveles, and Kelly 2005, Gee 2001) have shown this process to occur consciously through personal and social interactions and as a product of discourse and participatory action. In other words, you have to box in order to be a boxer. These raise interesting and complex issues in terms of identity, power, and in-group/out-group determination. Is a homosexual man being homosexual only through active participation
in “homosexual” activities? Is a Hawaiian woman Hawaiian only through active participation in “Hawaiian” activities? Am I still a man even if I do not do “manly” things?

 Nonetheless, Burke (1980, 1981) notes this reflexivity of “identities (that) are meanings that are formed in particular situations and organized hierarchically…and are symbolic and reflexive in character” (Burke and Reitzes 1981, 84). Individual actions, words, and appearances become symbolic to the point where the “reflexive character of an identity (and self-concept) integrate self-as-subject and self-as-object” (ibid). “The link between self-identity and behavioural (sic) intentions is predicated on the basis (of the conception) of the self not as a distinct psychological entity, but as a social construct” (Terry, Hogg, and White 1999, 226). However, researchers including Brewer (1996), Hitlin (2003), Hogg and Terry (2000), Hogg, Terry, and White (1995), Tajfel (1974), and Terry, Hogg, and White (1999) note that role identity only tells part of the story and is not an accurate predictor of situational behavior. Hitlin (2003) further elaborates on this viewpoint noting that “current debates (on and of the self) have drifted away from the more holistic discussions of the concept we find in the pioneers of work on the self, such as Dewey, James, and Mead, to a more fragmented, disjointed picture of self comprising a variety of disconnected and independently studied and theorized self processes.”

Identity researchers readily acknowledge the interplay between self and society however the influence of one on the other and one over the other has resulted in two schools of thought. Researchers who concentrate on the internal dynamics of self-processes and their impact of social structure and organization champion Identity Theory. Those who see social organizations and interactions (i.e. in-group/out-group membership,
culture) as the causal basis and/or primary influence on identity and focus on how social structures affect self subscribe to Social Identity Theory. There are differences in the specific terminology. Like Stets and Burke (2000), however, I believe that there are more similarities between these two theories than differences. That being said, I will briefly examine Social Identity Theory to gain a better understanding of how they fit together and combine both macro (social/societal-cultural) and micro (self) cognitive and motivational processes.

Social Identity Theory

Social Identity Theory (SIT) (Cornelissen, Haslam, and Balmer 2007, Ethier and Deaux 1994, Hogg, Terry, and White 1995, Hogg and Terry 2000, Stryker 1968, Tajfel 1974) offers insight into the dynamics of social structures and “suggests that humans derived the vital psychological resource known as ‘self-esteem’ (also known as self-efficacy in Identity Theory) through their identification with and belonging to groups” (Salzman 2008). This social identity approach postulates that the social is not external and separate to the self, but is internalized through a social identity (Postmes 2005, Tajfel 1974) and become a primary framework for the study of ethno-politico-religious conflict (Hargie et al. 2008, Lalonde 1994, Terry, Hogg, and White 1999). Hogg and Terry (2000) explain that “social identity rests on the intergroup social comparisons that seek to confirm or establish in-group-favoring evaluative distinctiveness between in-group and out-group, motivated by an underlying need for self-esteem” (122). Humans are social animals and “highly adapted to group living and not well equipped (physically, mentally, and/or emotionally) to survive outside a group context” (Brewer 1991). Social identity theorists challenge the “self”-centered nature of the overarching Identity Theory as inadequate to address much of human action in the form of collective behavior especially
in terms of groupthink (Stets and Burke 2000), risk and/or sacrifice to promote group benefit (Hogg and Terry 2000, Hogg, Terry, and White 1995), and attempts to establish/preserve distinctive group identities (Tajfel 1974).

“Intergroup relations – that is, how people come to see themselves as members of one group/category in comparison with another, and the consequences of this categorization” (Stets and Burke 2000, 226) are at the heart of the research based on social identity theory. The basis of social identity is uniformity of perception and action among group members – being at one with the group and seeing things from that group’s perspective. An integral part of this theoretical framework is the concept of self-categorization, which Hogg, Terry and White (1995) define as a process “that accentuates both perceived similarities…belonging to the same category and perceived differences…belonging to different categories” (260). Figure 2 represents a schematic representation of Social Identity Theory “where the concentric circles represent definitions of the self at different levels of inclusiveness within some particular domain” (Brewer 1991, 476).
The cognitive process is both generalizing and depersonalizing—referring to the change in self-conceptualization and the basis of perception of others (Hogg, Terry, and White 1995, Hogg and Terry 2000, Hogg et al. 2004, Tajfel 1974). This transformation process has both “positive” and “negative” consequences that include normative behavior, cohesion, cooperation and altruism, empathy, ethnocentrism, and stereotyping.

Being a part of the group and maintaining uniformity influences the view of the self as “prototypical” in the group. This in-group motivation is especially strong when a) no motivational forces exist to distinguish the self from others within the group (Cornelissen, Haslam, and Balmer 2007, Ethier and Deaux 1994, Halloran 2004, Haslam et al. 1999), and b) during times of real and/or symbolic threats from out-groups (Arndt et al. 2002, Florian 1998, Halloran 2004, Rosenblatt 1989, Solomon, Greenberg, and Pyszczynski 1991). While the level of identity that is activated (made salient) depends on factors in the situation, social identity theory holds that the person (or personal)
identity is the lowest level of categorization\textsuperscript{28}. Therefore the group identity, particularly during times of stress, threats to cultural/social anxiety buffers, and social comparison becomes the operative identity and overrides the personal identity (Burke and Reitzes 1981, Hitlin 2003a, Hoelter 1986, Riley 1995).

Both Identity and Social Identity Theories (and their closely related spin-off Self-Categorization Theory) attempt to address and predict behavior by placing emphasis on either the self (Identity Theory) or the social network (Social Identity Theory). Brewer (1991) attempts to unify these theories in the presentation of an optimal distinctiveness model based on the work of Codol (1984), Lemaine (1974), Maslach (1974), Solomon (1980), Snyder and Fromkin (1980), and Ziller (1964). This model (Figure 3) represents the need for assimilation and differentiation as opposing forces along a continuum.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{optimal_distinctiveness_model.png}
\caption{Optimal distinctiveness model (Brewer 1991, 477).}
\end{figure}

Despite differences, both theories view identity as integrated roles but limit this integration to a semi-rigid hierarchical network that represents the key to situational identity salience (Hogg et al. 2004, Onorato 2004, Stryker and Statham 1985, Tajfel
Hierarchical identity salience, however, is not an accurate predictor of behavior in so much as the situations that create the salience are structurally isolated. This hierarchical structure, while claiming to allow for the complexities of modern society, is built on historically, socially, psychologically, politically, and biologically constructed in-group/out-group binaries (i.e. Men—Women, White—Non-White, Heterosexual—Homosexual). This binary system is based on and reinforces the singular identity model in which an individual can have only one role (salience) at any particular moment in time.

Conceptualizing and acknowledging the existence of multiple identities, and therefore multiple realities, begins with the analysis of current binary discourse. In her analysis, Robinson (1999) modeled current modern discourse involving race, sex, sexual orientation, physical ability and class (Figure 4).

![Figure 4: Model on dominant U.S. discourses (Robinson 1999, 75).](image-url)
**Multiple Identities**

Researchers as Abes (2004, 2007), Brewer (1991), Jones (2000, 2009), Kiang, Yip, and Fulgni (2008), Moran (2003), Orbe (2004), Reed (2001), Stewart (2009), and Weber (1998) mirror Sen’s (2006) notions of the plasticity of identity, Appiah’s (2006) cosmopolitanism, and Solomon’s (2012) interactions between identities gained from peer interaction and those handed down from parents and families. The aforementioned research is seeking to reconceptualize models of identity to incorporate multiple dimensions of identity. Stewart (2009) explains, “these studies demonstrate (not only) that identity development was more of a cyclical process but also that the multiple facets of identity impinge upon each other and facilitate the continuing development and articulation of other facets of identity” (3). Almost all of the participants in the current study noted the importance of being a bridge. Being a link between the Hawaiian and science communities was an influential factor in the academic and professional decisions of the ten participants in this project. Acknowledging and celebrating multiple identities resists rigid labels and aids in developing new identity alliances. The participants in this project and others like them are, as Anzaldúa (2002) notes, making the bridges between worlds their home. Keating (2006) and the participants in this project note that navigating and reconciling multiple identities is not easy. The risk of being harmed by “isolation, misunderstanding, rejection, and accusations of disloyalty” (Keating 2006, 6) and having one’s sense of identity disputed, attacked, or impeded were echoed by almost all of the participants.

The need to reconceptualize the identity framework is born out of real life experiences of individuals that never fit neatly into the compartmentalized boundaries created by academic disciplines, anthropologists, and statistical analysts. Identity is fluid,
dynamic, and ever changing and it is difficult for us to conceptualize more than a handful of our identities at any given moment. In his own book *Difference and Repetition* (1994) and his collaborations with Felix Guattari in *Anti-Oedipus* (2009) and *A Thousand Plateaus* (1987) Deleuze creates an infinitely multidimensional identity paradigm in which what we would call our identity can be understood as the result of thousands of separate individual occurrences working in conjunction with each other but not necessarily bound by a whole (identity). In Deleuze’s philosophy, all identities are effects of differences created through experience and can be used to describe the inter- and intra-action of dimensions of identity down to the molecular level.

Much of the research-based theorizing on multiple identities developed through personal narratives in women’s studies literature (Abes 2007; Jones 2000, 2009; Weber 1998). This post-modern feminist research introduced social constructionism (Weber 1998) leading to a framework of intersectionality (Abes and Jones 2004, Abes, Jones, and McEwen 2007) both of which recognize how socially constructed identities are experienced simultaneously, not hierarchically (McCann 2002).

**Conceptualizations of Intersectionality for Race, Class, Gender, Sexuality**

Current research based on these frameworks focus on identity issues in connection with race, class, gender, and sexuality particularly in terms of power and oppression. Collins (1990) explains that “viewing relationships from an intersecting perspective expands the focus of analysis from merely describing the similarities and differences distinguishing these systems of oppression and focuses greater attention on how they interconnect” (295). Weber (1998, 16-25) identifies five common themes in this new scholarship: 1) Contextual—“race, class, gender, and sexuality hierarchies (and the meanings associated with them) are never static and fixed but undergo change as part of
new economic, political, and ideological processes, trends, and events;” 2) Socially
Constructed—race, gender, and sexuality are not fixed biological traits whose meaning
can be captured through their treatment as discrete variables. This practice typically
assigns individuals a single identity, defined by mutually exclusive categories, and
reinforces the view of race, gender, and sexuality as singular and unchangeable; 3) Systems of power relationships—“race, class, gender, and sexuality are historically
specific, socially constructed hierarchies of domination – they are power relationships.
They do not represent different lifestyle preferences or cultural beliefs, values, and
practices. They are power hierarchies in which one group exerts control over another;”
4) Social structural (macro) and social psychological (micro)—“race, class, and gender
relationships are embedded and have meaning at the micro level of individual’s everyday
lives as well as at the macro level of community and social institutions;” and, 5) Simultaneously expressed—“race, class, gender, and sexuality simultaneously operate in
every social situation…whether we are in dominant groups, subordinate groups, or both.”

Despite its complex contexts of boundary-crossing identities an unintended
presumption in any research, even post-modern feminist research, is the presumption of
unity within categories introduced to demonstrate differences (Abes, Jones, and McEwen
2007, Jones 1997, McCann 2002). “The coherence of any culture is not given by
members being the same, by members knowing the same things” (McDermott 1995, 326)
or by members experiencing the same things. Reed (1995) suggests, identity definitions
“are fastened by the categories that we have available, and by the ways that we submit to
those categories and subject others to them” (329). This “fastening” has often been used
to create perceptions of group solidarity that may “be perceived as either constructive or
destructive from the standpoint of the individual” (ibid). “The complexities of identity
development in a postmodern world are not fully captured without attention to multiple
and intersecting identities and the sociocultural contexts in which identities are
constructed and negotiated” (Jones 2009). This multidimensional approach to identity,
including Jones’ (2009) research questions, will be elaborated on in Chapter 3.

Weber (1998) reminds us “that almost all of us occupy both dominant and
subordinate positions and experience both advantage and disadvantage in these
hierarchies” (24). There are no pure oppressors or oppressed in our society. Robinson
(1999) elaborates on this further when she explains how “many of us erroneously believe
that if we do not have membership in a particular group, then we are immune from the
way in which this group is affected by oppression” (73). Jones and McEwen (2000) cite
Reynolds and Pope’s (1991) attention to this concept (multiple identities) through their
case study research, subsequent discussion of multiple oppressions, and the creation of
the Multidimensional Identity Model suggesting four possible ways for identity
resolution for individuals belonging to more than one oppressed group.

**Multidimensional Identity Models**

“The available identity development theories,” as explained by Reynolds and Pope
(1991), “as well as the general literature about culturally diverse groups have rarely
examined or acknowledged the multiple layers of diversity and identity and instead offer
one-dimensional images of culturally diverse individuals” (70). This model (Figure 5)
was “created from a matrix with two dimensions – the first concerns whether one
embraces multiple oppressions or only one oppression, and the second concerns whether
an individual actively or passively identifies with one or more oppressions” (Jones and
McEwen 2000, 406). The value of this model, Jones and McEwen (2000) explains, is in
its “attention to the possible danger of considering an individual’s identity development too narrowly by only using identity models that address singular dimensions of one’s identity and their attention to identity resolution” (406).

The four quadrants or options become: 1) Identification with one aspect of self (i.e. gender, sexual orientation, or race) as assigned by society; 2) Conscious identification with one aspect of self; 3) Identification with multiple aspects of self in a segmented fashion – frequently one at a time with salience determined passively by context rather than by the individual (i.e. in one setting the individual identifies as Hawaiian, yet in another setting as gay); and, 4) the individual “chooses to identify with the multiple aspects of self, especially multiple oppressions, and has both consciously chosen them and integrated them into one’s sense of self” (Jones and McEwen 2000, 406).

Despite the generation of Reynolds and Pope’s model Jones and McEwen (2000) lament that “researchers have only minimally addressed multiple identities, contributing no application or testing or their model and little follow-up to their work” (ibid). Recent research in the area of multiple identities using Reynolds and Pope’s model has resulted
in more complex models that take into account the interrelationships between multiple identities. These models, while represented as static figures in their research articles and this literature review, are meant to be fluid and dynamic “representing the ongoing construction of identities and the influence of changing contexts” (Jones and McEwen 2000, 408). Acknowledging the existence of multiple identities does not preclude the interplay between the micro (self) and macro (social) cognitive and motivational processes. If anything, it enhances them. At the center of newer models of multiple dimensions of identity including those developed by Jones and McEwen (2000) (Figure 6) and Abes, Jones, and McEwen (2007) (Figure 7) is a core sense of self (Abes and Jones 2004, Abes, Jones, and McEwen 2007, Gee 2001, Jones and McEwen 2000, Jones 2009) or personal identity. This core combines personal attributes, personal characteristics, and personal identity and is somewhat protected from view and was referred to by their research participants as their “inner identity” or “inside self.” This mirrors the findings of this study in which each of the ten participants referred to particular aspects of their overall identity as part of their core and as an anchor that grounds and guides them.
Encircling the core, and at times connecting with the core, are what can be described as externally defined dimensions of identity including, but not limited to, gender, race, culture, religion, class, and sexual orientation. “The intersecting circles of identity in the model represent significant identity dimensions and contextual influences” (Jones and McEwen 2000). These dimensions are variously experienced with the intersections demonstrating that no one dimension may be understood singularly. Instead, single identities can be understood only in relation to other dimensions. The context – family background, sociocultural conditions, current experiences, and career decisions and life planning – within which and individual experiences multiple dimensions of identity is represented by the larger circle that includes both the core and intersecting identities.
The multiple dimensions therefore interact with both the core identity and the social/societal contextual influences allowing the individual to perceive and experience identity as both externally defined, internally experienced, and influenced by different contexts.

Extending this model through further research using a constructivist theoretical framework (Abes and Jones 2004, Bowleg 2008, Hancock 2007, Jones 2009, McCall 2005) and Erikson’s (1980) description of identity led to the integration of meaning making capacity into the model of multiple dimensions (Abes, Jones, and McEwen 2007) (Figure 7). In this model, social identity dimensions are represented in a similar manner as Jones and McEwen (2000). The meaning making structures leading to this reconceptualization included “a) unexamined satisfaction with external meaning-making (formulaic); b) 2 definitions; c) tentative internal meaning-making with the possibility of retreat (crossroads); and, d) an appreciation for an internally defined identity (foundational)” (Abes, Jones, and McEwen 2007).
Abes, Jones, and McEwen (2007) explain, “meaning making capacity is drawn as a filter. How contextual influences move through the filter depends on the depth and permeability of the filter” (6). The relative depth and permeability is dependent upon the complexity of the individual’s meaning-making capacity. A more complex meaning making capacity could be represented with a thicker (increased depth) and smaller grid openings (more selective permeability); a less complex meaning making capacity could represented with a narrower filter (less depth) and wider grid openings (less selective permeability). Regardless of these differences in meaning making capacity, context (i.e. social, historical, cultural) influences identity perceptions and the “differences in the depth of the filter and size of the grid openings incorporate these contextual influences in qualitatively different ways” (ibid).
Both of these models represent the interconnection between micro and macro processes and the interplay between identity dimensions. Within each of these models you will notice dots along each of the identity dimension circles. These dots indicate the importance, or relative salience, of these identity dimensions. “The location of the dot and its proximity to the core represents the particular salience of that identity dimension to the individual at that time” (Jones and McEwen 2000). For example, if culture is salient at that point in time, the placement of the dot on that dimension is closer to the core. Conversely, if sexual orientation is not particularly salient to an individual at that point in time, the dot is farther away from the core. The aforementioned models of multiple identities illustrate that various identity dimensions are present in each individual, experienced in different ways depending on both internal and external cognitive processes and influences, and results in an identity (or identities) being more or less salient at any particular moment in time. The study of identity salience, especially when we consider the interaction between multiple identities, has the potential to reveal important findings relevant for understanding the multifaceted and complex ways in which individuals perceive and make meaning of the multiple dimensions of their overall identity.

Identity Salience Research

All three frameworks view identity salience—one “role” being more or most prominent—as an important part of the identity of the individual. Related to identity salience, “role engulfment, occupational identification, central life interests, psychological centrality, and role commitment have all been similarly used in an attempt to describe differing self-evaluations of role-identity” (Callero 1985). That being said, the root processes behind these theories that ultimately result in salience differ. Identity Theory places emphasis on the internal cognitive processes. Social Identity Theory focuses on the motivational influences of social in-group/out-group membership. Despite the variations between them, both assert that the self must be seen as complex and differentiated (and) that the self must be conceptualized as constructed from diverse “parts.” One can speak meaningfully of familial identities, political identities, occupational identities, and so on, all of which are incorporated into the self as that which is an object of self. These theories conceptualize identities (roles) as part of a semi-rigid hierarchy where salience occurs through cognitive processes, socially generated motivations, or some degree of both that enable one or more identities to affect what Stryker (1968) referred to as the “threshold of invocation.”

The salience hierarchy is situationally driven. Burke (1980) explains that “each identity is more or less likely (relative to other identities which the individual has) to be enacted or portrayed or taken into account, depending upon its position in the salience
hierarchy. Those identities at the top of the hierarchy are more likely to be invoked than those at the bottom, and to be invoked in more situations” (19). Reed (1995) uses the image and metaphor of fastening and unfastening identities in this same way. This metaphor “suggests that although identities are sometimes fastened by laws and conventions, they are also negotiated” (Reed 2001, 329). However, Burke (1980, 1981) and to a certain extent Hogg et. al (2004), Hogg and Terry (2000) and Hogg, Terry, and White (1995) warn us that identities cannot be measured in isolation in so much as one identity (i.e. gender) can have little to no impact on the individual and social perceptions and saliences of other identities (i.e. ethnicity). The result was the generation of identity generalizations and assumptions. For example, generalizations and universal applications would be made about the experience of gender salience for women. Even though the research and resulting literature could be considered feminist, it did not take into account the very real experiential differences between black women and white women. As Tavares (Tavares 2008) asserts, “the fractured discourses…expose the power differentials embedded in its framework, particularly around issues of embodiment, and, at the same time, insist upon a treatment of racialization, the fact that not all women enter into spaces…on equal footing” (377).

The aforementioned researchers also warn that “the measurement of those identities at the ‘top’ of the salience hierarchy will be less problematic than the measurement of those identities at the ‘bottom’ of the hierarchy” (Burke 1980). As a result, research frameworks that did not specifically seek out experiential differences within a given identity (i.e. gender) and intersections with different identities (i.e. ethnicity, class) did
not find them. Studies constructed to generate universal “truths” got the results they wanted.

The Intersectionality framework however, suggests identity salience is more fluid and dynamic with multiple dimensions of identity interacting with each other at any particular moment accounting for the multiple realities of individuals even within the same identity group. This framework not only allows for the possibility of one identity dimension being “viewed” through the lens of another identity dimension but also the possibility of multiple saliences. Like Identity Theory,Intersectionality assumes that individuals can have a number of hierarchically ordered identities. Intersectionality, subsequent Multidimensional Model of Identity and the related Multidimensional Model of Racial Identity (Sellers et al. 1998, Stewart 2008, 2009) argue that each identity has both “stable and situationally specific properties. These situational and dynamic properties interact to provide a mechanism for explaining how identity can influence behavior at the level of the situation (molecular level) and exhibit consistency across situations (molar level)” (Sellers et al. 1998).

Identity salience, as both a theoretical and/or experimental focus, has produced a wide range of research. Of particular note are studies utilizing the Intersectionality Model relating to gender (Bianchini 2000, Cameron 1998, Jones 1997, Jones and McEwen 2000, Jones 2009, McLaren 1995, Parks 2004), religion (Fisher 2001, Hargie et al. 2008, Kinnvall 2002), disability (Fischer 2001, Martin 1997, Nikolaraizi 2006), and sexuality (Eliason 1996, Hoffman 2004, Parks 2004). In some cases, such as Bowleg (2008), identities are combined to explore identity interactions as well as qualitative/quantitative research challenges such as representing the intersectional rather than additive nature of
identity accurately. These studies seek to understand the psychological lives of individuals as they make meaning through different identities, particularly those outside the “norm” of society. As of late, there has been a good deal of research on racial and ethnic identity development and salience particularly among minorities and discriminated groups.

Racial identity is one of the most heavily researched areas of identity theory and identity salience. Racial identity has been associated with a number of phenomena including self-esteem, academic performance, preference for same-race counselor, preference for same-race sexual partners, and career aspirations. Historically, racial identity research has been limited to Blacks/African Americans and has resulted attempts to model racial identity salience (Figure 8) as well as the process by which racial identity determines behavior (Figure 9).

![Multidimensional Model of Racial Identity (MMRI)](image)

*Figure 8: Schematic representation of the multidimensional model of racial identity (MMRI) (Sellers et. al. 1998, 24).*

**Indigenous Identity Research**

Like other areas of racial identity research, Indigenous identity development/salience are growing fields of research for both indigenous and non-indigenous researchers. Building on the post-modern constructivist ideal of providing a voice to those who have been historically voiceless research with members of the Canadian, Aboriginal (Aikenhead 2001a, 2002a, Aikenhead 1999, Baturo 2004, Hallet 2008, Sawchuk 2001),

Contact with American and Europeans brought rapid and radical change to the lives of Indigenous Peoples. Outside forces acquired social and political control over native populations and subsequently imposed the dominant (white) society’s hegemonic agendas thus marginalizing and subjugating traditional culture (Chinn 2007b, Jester 2002, Kawagley 1999, Meyer 2001a, Smith 2004, Steuber 1981, Weber 1998). The consequence of this is an extraordinarily confusing and contentious issue when it comes to Indigenous Identity especially as traditional symbols, meanings, and knowledges were replaced with definitions, deeds, and legal terms (Corntassel 2003, 2008, Merry 2000, Muehlebach 2010). As Weaver (2001) laments, “there is little agreement on precisely what constitutes indigenous identity, how to measure it, and who truly has it” (240). Owl (1962) explains that “although the United States serves as the legal guardian of American Indians, it has no clear-cut definition telling exactly what constitutes an American
Indian” (265). As a result various unofficial expressions to describe and classify individual and classes of Indian including “enrolled/non-enrolled Indian, full-blood, mixed-blood, breed, competent/incompetent Indian, reservation Indian, Christian Indian, citizen Indian, and white Indian” (ibid) based on blood quantum and levels of assimilation in to the dominant society. These random and colloquial classifications have created artificial methods of separation within Native American communities based on three facets of identity – self-identification, community identification, and external identification. Previously unclear and artificial identifications have deprived many Indigenous individuals of tribal rights and resources as well as psychological stability (Barker 2003, Brown 1993).

The past thirty-five to forty years has seen a renaissance in Indigenous art, culture, thought, and political activism. Social, cultural, and educational “analysis and representation of indigenous peoples is undergoing an important transformation” (Field 1994). Theorists, researchers, practitioners, and activists such as Aikenhead (2006), Belczewski (2009), Friere (2000), Laenui (2000), Ma’aka (2005), Smith (2004), Thiong’o (1986), and Wilson (2005) would call this process decolonization. This process involves “rereading” from a postcolonial perspective and, as Tavares (2003) explains, “critically questioning those rationalities through which colonial endeavors were organized” (437). It also involves the rejection of the colonialist/universalist/postpositivist framework of the Enlightenment in favor of recognition of previously disregarded identities. Tavares also notes that as this process is ongoing we currently lack the appropriate language to confront and challenge the “persistence of colonial discourse” (ibid). Therefore, “a new literature is challenging the
more established conceptualization of indigenous peoples…with focus on the processual nature of indigenous identities” (Field 1994) to transform self-representations of indigenous social groups, gain recognition, and resist domination by social, political, and economic power structures while recognizing the need to exist in the modern world.

The decolonization process as well as the post-modern conception of identities as “fragmented, multiply constructed, intersected in a constantly changing, sometimes conflicting array” (Weaver 2001) the impact of which on Indigenous identity changes over time, has led both indigenous and non-indigenous researchers to explore indigenous-related issues and expand indigenous-related knowledge(s) in new and creative directions.

**Hawaiian Identity Research**

To lump Hawaiian identity, and the issues Native Hawaiians face as they determine who they are, in with other Indigenous groups would be reductionist on multiple fronts to say the least. However, there are social, psychological, and historical similarities between Native Hawaiians and other Indigenous Peoples. Just as with other Indigenous groups, Native Hawaiians are victims of arbitrary and artificial divisions generated by the dominant culture especially blood quantum. Jon Osorio (2001) brings this discussion to the forefront when he asks, “for if being a descendent of a Native makes one Native, what if anything does blood quantum have to do with who we are? Does the dilution of Hawaiian ancestry in any significant way change the ethnicity of the individual?” (361). Scholars of assertive literature, having been deprived of their own self-identification methods, are beginning to explore ways to self-identity with their traditional culture and values and to (re)create a Hawaiian community through shared language, culture, and practices. The historical trauma experienced by Native Hawaiians has been “passed down
through the generations (to the point where) descendants of people who have suffered genocide not only identify with the past they also emotionally re-experience it in the present” (Cook, Withy, and Tarallo-Jensen 2003). Symptoms of trauma include higher than average suicide rates, depression, self-destructive behavior, physical/emotional/sexual abuse, poor health conditions, as well as drug and alcohol abuse (Cook, Withy, and Tarallo-Jensen 2003, McMullin 2005, Salzman 2004). As a result, these have become frameworks from which many researchers explore Hawaiian Identity.

The challenge, as with any culture that has experienced both physical and existential trauma, is to recapture what was lost while acknowledging the need to move forward. This has resulted in some friction within the Native Hawaiian community as members seek to (re)define culture and values, to heal wounds, and restore culture and psychological balance (Cook, Withy, and Tarallo-Jensen 2003, Kauanui 2008, Linnekin 1983, McCubbin, Ishikawa, and McCubbin 2008, Osorio 2001). Osorio (2001), Sing et. al. (1999), and participants in my pilot study note that the biggest challenges to “Hawaiian Identity” come from fellow Hawaiians leading to members of the in-group to suddenly find themselves to be outsiders.

Osorio reflects upon his personal experiences in What Kine Hawaiian Are You? on times when his Hawaiian-ness was challenged because he did not want to eat certain “Hawaiian” foods such as ake or ‘ulu. Lopaka, from my pilot study, commented on friends from high school giving him a hard time when he returned from college in the continental United States because he chose to use his given name instead of a “Hawaiian” name. Additionally, several participants in this study commented on how their choice of
science as a career put them at odds with friends, who are also Hawaiian, because those friends did not see science as a “Hawaiian thing.”


There has also been a growing body of research involving professional identity salience for those individuals involved in the sciences. In what seems like a concerted effort to make science more “multicultural” researchers such as Brown (2004), Chinn (2002, 2006), Hurtado (2008), Zuniga (2005) have focused their energies on minority, disenfranchised, and traditionally underrepresented groups in the sciences.

Science-as-Professional Identity Research
Research by, with and for traditionally underrepresented groups in the sciences has explored issues related to equity, the culture of science, curriculum and pedagogy, and identity. The lived experiences of the ten participants in this study mirrored scholarly literature connected with professional identity and/or professional identity salience. Research on this subject can be aligned with three broad groups: 1) experiences of first-
generation minority college students in the sciences, 2) experiences, challenges, and motivations as women in science, and 3) experiences and challenges as underrepresented minorities in the sciences.

**First Generation College Student in the Sciences**

Unbeknownst to me at the time of selection, all of the participants in this project are among the first-generation of their family to attend college, let alone pursue and receive advanced degrees. Zalaquett (1999) notes that the number of college students who are the first in their families to attend a postsecondary institution is growing as a college degree becomes a prerequisite for employment” (417). All college students face academic, social, and psychological challenges. “First-generation students face unique challenges in attaining a degree, such as conflicting obligations, false expectations, poor preparation, and lack of support, which may hinder their success” (ibid).

While there is a wealth of research with a focus on aspirations, there is very little on the achievement of postsecondary degrees. Longitudinal studies such as Grandy (1998) and McCarron and Inkelas (2006) are providing “practitioners in identifying and defining the holistic needs of first-generation college students throughout their transitions” (535). Locally, such studies have led to the creation of peer mentoring programs, culturally based cohorts, and pre-college academic programs, and increased scholarship and internship opportunities—all of which were advantageous to the participants in this research study. This study does not focus on the aspirations, motivations, transitions, and attainment of college degrees. However, the participants’ individual and shared experiences in receiving postsecondary and advanced degrees in the sciences will shed light on these processes.

With an emphasis on diversifying science, much of the aforementioned literature focuses on minorities, primarily African-American/Black, Latino/a, Asian, and immigrant college students. Despite dramatic increases in the number of scholarships available for Indigenous students, particularly first-time college students, there is very little literature available regarding their experiences. Scholarly works such as Aikenhead (1997, 2006), Brandt (2008), Chinn (1999b, 2002), Kawagley, Norris-Tull, and Norris-Tull (1999,
1998), Kawaguchi (2003), Maaka (2005), Malezar (2002), McKinley (2005a), Meyer (1998b), Tavares (2007, 2008), and Whitnui (2008) are exploring the experiences of Indigenous students in college (science) classroom. However, the lack of literature in relation to first-time Indigenous college students is an area on which this research project can shed light.

**Women in Science**

Despite the progress that has been made over the past 30 years to narrow the “gender gap” in science, women continue to be underrepresented and marginalized in science, technology, engineering, and math-related fields (National Science Foundation 2013, AAUW 1998). “There have been myriad approaches, evolving and growing over time, where researchers continue to investigate strategies for engaging girls in science” (Brotman and Moore 2007, 971). Experiences by girls and women in relation to science include feelings of inadequacy, marginalization, and alienation. Half of the participants in this project are female. This research project lacks a comprehensive gender analysis regarding the experiences of women in science. However the stories of the female participants in this project are “important in terms of creating an awareness that girls generally do not fare well in science classes (and) we want to tell those stories” (Brickhouse, Lowery, and Schultz 1999, 442).

2008, Brown 2004, Burkam, Lee, and Smerdon 1997, Carlone 2004, Henwood and Miller 2001, Hurtado et al. 2007, Ong 2005, Tate and Linn 2005). The narratives of the five female participants can provide scientists and educators with a better understanding of the gender-based challenges that must be navigated to enter and succeed in science, technology, engineering, and mathematics. As “women of color,” the participants “fit even less easily than White women into university science classes” (Johnson 2007, 806). Overall, as scientists of color, all of the participants faced unique challenges on their way to finding success in the sciences.

**Underrepresented Racial/Ethnic Minorities in the Sciences**

Historically, both men and women of color have faced overt discrimination in science settings. Racial/ethnic identities have also been explored as they relate to underrepresented minorities in the sciences. Phinney and Haas (2003) note that “ethnic minority college freshmen…face a number of stressors over and above those identified for college students generally. With parents whose level of education is often only high school completion or less, these students are likely to come from low-income households and to have greater financial needs than middle class students” (709). Literature examining the relationships between African-American, Latino, and Asian racial identity and science student/scientist identity has explored social, political, and pedagogical issues from a first-person standpoint.


There is also an expanding body of research involving science/science education and Indigenous peoples. Nonetheless, some issues in the literature emerged. First, research regarding science/science education and Indigenous Peoples is often in relation to the interaction of (with a focus on the disconnect between) so-called “Western Science” and Indigenous knowledges, the infusion of Indigenous culture and practices into the science curriculum, and the existence and place of “Indigenous Science” (also referred to as Traditional Ecological Knowledge (TEK)) in the science/science education framework.

**Who’s Knowledge? Science Education by/for/with Indigenous Peoples**

Until recently, science education materials and programs designed specifically for use with indigenous peoples were geared specifically towards assimilation and acceptance of western scientific methods over native cultural beliefs (Kana‘iaupuni 2005). Harding (1998) critiques the *Europology* of modern sciences and argues a “distinctively European component of the cognitive core of modern science…is the claim to, and valuing of, cultural neutrality.” This is a paradox as value-neutrality is distinctly “European” and trying to “maximize cultural neutrality, as well as claiming it, expresses a culturally specific value” (ibid).
Recently there has been a paradigmatic shift by some in the scientific, educational and philosophical community to find a way to bring balance to this curriculum by focusing on the educational strengths of Native Hawaiians and other Indigenous peoples. There have also been calls by some in the educational community to incorporate both western scientific practices and indigenous knowledge into the science curriculum (Aikenhead 2001a, 2002a, Baker 1996, Barnhardt and Kawagley 1998, Cobern and Loving 2001, Michie 2002, Padilla 2005, Simonelli 1994c, b, Stanley 1994, Stanley 2000). Articles by and on the subject of Hawaiians and education were mostly concerned with Native Hawaiian epistemology and curriculum reorganization such as Kaholokula (2003), Kana‘iaupuni (2005), Meyer (1998b, 2003), and Sing (1999). These scholars challenge misconceptions “based on foreign perceptions of reality” (Kana‘iaupuni 2005) that non-Hawaiians have of Hawaiians, specifically students. This challenge and the research that stems from it is an effort to improve student performance through cultural experiences (Kaholokula 2003; Meyer 1998; Sing 1999) during and after school, the creation of a native teaching force (Manuelito December 2003), the use of strengths-based approaches to education, and the creation of Hawaiian culture-centered schools (Kaholokula 2003; Meyer 1998).

Various authors and researchers have approached the issue of Indigenous identity and science/science education from an array of vantage points. This research does not seek to address science education methods. Nor will it involve the creations of interventions to address achievement gaps and/or potential inequity for Native Hawaiian students within the science classroom. That being said, disconnections between Native Hawaiian and science teacher/student/scientist identities for the participants may be a result of their
experiences in science classes. Since there are interview questions having to do with this particular issue it is important to have an understanding of current research and movements involving the Indigenous Knowledge(s) and science education. To provide structure I have sub-divided this section in to three groups to discuss science and science education from both the multiculturalist and infusionist points-of-view and to briefly address the question of “Indigenous Science.” These sections are by no means exhaustive and are not meant to mark an end to ways to make science curriculum more inclusive and equitable. Instead, this will provide an overview of scholarly thoughts and research as well as some theoretical and research-based critiques of the singular identity framework to make the case for additional research using a post-modern, constructivist model of multiple identities.

**Multiculturalists**

One of the largest groups of researchers is the multiculturalists. Authors including (Aikenhead 2006, Bang and Medin 2010, Brickhouse and Kittleson 2006, Chambers 2000, Cobern and Loving 2001, Costa 1995, Gauch Jr. 2006, Kawagley, Norris-Tull, and Norris-Tull 1995, Kawagley and Barnhardt 1998, Ninnes 2000, O'Loughlin 1992, Padilla 2005, Siegel 2002, Simonelli 1994b, Stanley 1995) have examined science curriculum and the disconnect between so-called “Western” science with other ways of knowing by calling for more of a “world view” within science textbooks and the curriculum they espouse. Major arguments for this paradigm change stem from previous education models “designed for indigenous peoples (that) used science as the tool of choice to modernize and supplant indigenous culture” (Cobern 2001). Additionally, the need for a “scientifically literate global society” has prompted individuals and groups such as Michael Padilla (past president of the National Science Teachers Association (NSTA) to
create strategic plans to improve teacher and student science education. At the fundamental level, Stanley (1994) poses three important questions that multiculturalists have been seeking to answer: “Whose culture are we teaching? Whose knowledge is of most worth? Who benefits and who is harmed by current approaches to curricula?” By raising these important and difficult questions researchers prescribing to this mode of thought are attempting to create a dialogue that will affect science curriculum, teacher training and challenge the prevailing universalist (scientistic) paradigm that dominates today’s science classrooms. With any challenge to the status quo come questions of appropriateness, feasibility and, in this case, whether it is good science. Tabak (2005) puts the whole idea of multiculturalism into perspective by simply asking, “Is multicultural education an important dimension in science education?”

**Infusionists**

A second group of authors that include (Aikenhead 1997, 2001a, Boyne 2003, Chinn 2005, 2008, 2009, 2011, Corsiglia and Snively 2000, Huntington 2000, Kawagley, Norris-Tull, and Norris-Tull 1995, 1998, McKinley 2005a, Michie 2002, Reed 2008, Simonelli 1994a) I will refer to as the infusionists. These researchers have sought to reconcile the apparent disconnect between science education (as well as education in general) and indigenous knowledge by advocating for the infusion and incorporation of indigenous knowledge and ways of knowing specifically into the current science curriculum. The basis of this argument is to challenge methods in the “teaching of science in the United States (that are) dominated with examples of the contributions of European and American scientists” (Kawagley 1995) while ignoring the contributions of indigenous peoples.
These researchers believe that today’s science focuses more on teaching students to “think like a scientist” (Aikenhead 2001) while acculturating students into a “mechanistic, reductionist, empirical, mathematically idealized, exploitive, impersonal and elitist” (Aikenhead 1997) ways of science. The result of which is either assimilation of indigenous peoples or the alienation of indigenous students in the science classroom. To compensate, the science curriculum should be adjusted to move away from the aforementioned negative qualities and embrace traditional, indigenous ways of knowing “in a non-tokenistic way – informed and not dismissive in its status” (Michie 2002). By incorporating knowledge of this type, science becomes accessible to indigenous students, respectful of their cultural heritage. As Boyne (2003) explains:

> Teachers should use practices consistent with how Native students learn mathematics and science and should include simultaneous processing (seeing the whole picture) instead of successive processing (analyzing information sequentially), instructions that build on Native strengths as learners, using hands-on material or manipulatives and structuring classrooms to support cooperative learning (p. 18).

This locale-specific science curriculum utilizes indigenous peoples “abilities to observe and remember years of sensory information and also our ability to make useful inferences” (Corsiglia 2000). Stephens (Stephens 2001) *Handbook for Culturally Responsive Curriculum* argues in favor of this curricular worldview citing three factors leading to “powerful implications for students” (p. 10). “The first is that a student might conceivably develop all of the common ground skills and understandings while working from and enhancing a traditional knowledge base. The second is that acquisition of the common ground, regardless of route, is a significant accomplishment. And the third is that exploration of a topic through multiple knowledge systems can only enrich perspective and create thoughtful dialog” (Stephens 2001, 10).
The paradigm shift in science curriculum is associated with holism of knowledge and sustainability as opposed to “specialization and the excessive division into disciplines many feel has separated science from the good of society” (Simonelli 1994).

**Does “Indigenous Science” exist?**

In this same vein, researchers have argued that a way to incorporate indigenous knowledge into the science curriculum is through the addition of the word “science” (i.e. native science and Indigenous science). Both types of science “consist of a set of explanations which seek to make sense of the natural world” (Baker 1996) and involve prediction, theory formation, experimentation and explanation (Aikenhead 2002a, b, Baker 1996). However, researchers stress that so-called Western science emphasizes qualities such as logic, rational empiricism, compartmentalization, and science done just for the sake of new knowledge and is teacher (expert) centered. Indigenous science, on the other hand, focuses attention on cohesiveness, participation, relationships, sensation, imagination, emotion, and symbols and is dialogical. “Indigenous science is the process by which indigenous peoples study and live with their surroundings to achieve complete balance and well being” (Naone 1995). Due to these inherent differences in structure and purpose, the teaching of so-called Western science to indigenous students often leads them to become disengaged from science. “In some cases, the disparity between home and school environments is so great that some Native American (and native Hawaiian) students experience a kind of culture shock which significantly affects their attitudes toward school” (Cajete 1994). Conversely, some scholars see similarities between traditional native knowledge and so-called Western science arguing that this common ground can be used to support indigenous students in the sciences in ways that support traditional culture and enable students to function in the dominant culture as well.
Accordingly, acknowledging the importance of indigenous science and infusing it into the current science curriculum could encourage more active indigenous student participation as well as creating value for indigenous knowledge for non-indigenous students.

Research with Native Hawaiians Compared with Other Indigenous Peoples

The second issue encountered within this realm of research literature is in the amount of research regarding science/science education with Native Hawaiians. Researchers and scholars such as Aikenhead (2006), Chinn (2005, 2006, 2007, 2008, 2009, 2011), Kaholokula (2003), Kana’iaupuni (2005), Sing, Hunter, and Meyer (1999) have expanded the volume of research in connection with Native Hawaiian identity and science however, this research pales in comparison to the breadth of research with other Indigenous peoples, minority groups, and dimension of identity. The relationships and interactions of Indigenous peoples and science/science education research tends to concentrate on American Indians/Native Americans (Barker 2003, Brandt 2008, Cajete 1994, 2000,
As I mentioned previously, other minority identity research in connection with science has begun to focus on the experiences of individuals in those fields in order to develop a more holistic conceptualization of that reality. Indigenous research in connection with science, as it develops and broadens, has begun to move in this direction. Researchers such as Chinn (2002, 1999a, 1995), McKinley (2005, 2007) and Simonelli (1994) have performed narrative research with members of the science community, particularly women, with great success. The results have provided rich, contextual information about the unique experiences of individuals becoming members of the science community and the meanings the participants have made through their experiences and challenge previous universalist/reductionist/colonialist attitudes regarding participation science fields.

**Exploration of Particular Branches of Science**

Lastly, the body of literature regarding science/science education literature for/with Native Hawaiians focuses primarily on the biological/life and earth/space branches of science. From a historical/perspective there are many more links between what we refer to as “traditional knowledge” and the biological/earth sciences. As was noted by all three of the participants in my pilot study, as well as literature including Chinn (2005, 2011) and Kana‘iaupuni (2005), Hawaiians were very skilled in science including agriculture, astronomy, classification, engineering, and navigation. I ka nana no a ‘ike (*By observing,*
one learns) (Pukui 1983). Based on cultural and geographic strengths these knowledge areas researchers, educators, activists, and practitioners have called for shifting the scientific paradigm to include strengths and place-based curriculum. These efforts have resulted in statewide guidelines such as Nā Honua Mauli Ola: Hawai‘i Guidelines for Culturally Healthy and Responsive Learning Environments (2002) developed by the Native Hawaiian Education Council and Ka Haka ‘Ula O Ke‘elikōlani College of Hawaiian Language, curriculum such as Aloha ‘Āina and Mālama Kaho‘olawe developed by the Pacific American Foundation and funding for programs such as Mālama I ka ‘Āina (Chinn 2011), Na Pua No‘eau, and the Kahuewai Ola Native Hawaiian STEM Scholars programs at the University of Hawai‘i.

I applaud and support these programs and have used place-based curriculum in my own science classroom. However, I find the lack of apparent interest in exploring the experiences of Hawaiian men and women in fields such as medicine, engineering, chemistry, and physics disappointing. It is also disappointing that many of the aforementioned programs and curriculum do not take advances in various fields in to consideration. For example, a major component of current biology curriculum is an exploration of genetics. Since this topic and others like it do not connect easily to Native Hawaiian tradition or traditional beliefs, is someone who pursues a degree and career in genetics less Hawaiian? Can a Hawaiian in science do only Hawaiian science? Can they be Hawaiian doing science, regardless of what that field of science may be? In order to gain an understanding of the experiences, influences, and processes involved with the formation of identity for Hawaiian members of the science community, a community in which they are severely under-represented, we must cast as wide a net as possible and
encourage the participation of Native Hawaiian science students, science teachers, and scientists in as many branches of science as possible. An analysis of Native Hawaiian identity in connection with science, technology, engineering, and mathematics must look beyond fields that easily link with traditional Hawaiian knowledge. To do so will help us gain a fuller and deeper understanding of the experiences of being a Hawaiian member of the science community.

This project, using a narrative approach guided by post-modern, constructivist, multiple identity theory perspectives, seeks to understand the lived experience of identity construction and negotiation with Native Hawaiian members of the science community when multiple identities are considered. How are these identities experienced and constructed? What are the contexts that influence and shape identity? What are the contexts that influence the salience of these dimensions of identity? Does fastening one identity require the unfastening of another identity? This doctoral project seeks to uncover patterns in multiple dimensions of identity in order to determine the roles that personal, social, and professional categories have in the lives of Hawaiian members of the science community.

**Literature Review Summary**

Identity research is not a new branch of study as evidenced by the variety of theories, models, and directions explored in this literature review. Although there are differences between competing theories, there are also similarities. Symbolic interactionism, identity theory, and social identity theory view identity as integrated roles but limit this integration to semi-rigid hierarchical networks built on in-group/out-group frameworks. Both theoretical and research-based multiple identity research, on the other hand, look at the plasticity of any given identity and ways in which multiple dimensions of identity
intersect, interact, and change based on new processes, trends, and events in an individual’s lifetime. Within these theories, racial identity has become the most researched dimension of identity with emphasis placed on traditionally marginalized groups such as women, individuals with disabilities, and ethnic minorities. While the quantity of Hawaiian/Indigenous identity research pales in comparison to other ethnic groups, it has been consistently growing as scholars look for ways support the decolonization process and give voice to underrepresented groups in areas such as higher education and the sciences. Research, such as this project, with Native Hawaiians and other Indigenous peoples will expand the body of knowledge and give voice to those who are actively navigating, negotiating, and reconciling the intersection and interaction of their Hawaiian/Indigenous identity with other social, cultural, and professional identities.
CHAPTER 3. METHODOLOGY

We continually and actively build and rebuild our worlds (identity)…in tandem with actions, interaction, non-linguistic symbol systems, objects, tools, technologies, and distinctive ways of thinking, valuing, feeling, and believing. (Gee 2005)

This chapter provides an overview of the methodology that was used in this study and presents the rationale for a combined theoretical framework. It describes each of the contributing frameworks (grounded theory, case study) and how they were combined with and complimented an Indigenous methodological framework, the purpose, research questions, and the methods that were used to conduct this study. Descriptions of the participants, survey and data instruments, methods used to provide validity, reliability, and credibility are also presented. Data collection and data analysis procedures are also described in addition to a discussion of bounding for this particular multiple-case study and ethical considerations. The chapter concludes with some reflections regarding the overall methodology and methods used to conduct this research project.

Review of the purpose and research questions

The purpose of this study was to gain an understanding of how identity is constructed and negotiated through the lived experiences of Native Hawaiian members of Hawai‘i’s science, technology, engineering, and math (STEM) community. It was designed to collect and analyze qualitative data gleaned from the oral histories of ten (10) individuals. The purpose of the research was to explore the complexities of identity development using a critical case study approach and draw upon the results to explore the relationships between intersecting and potentially contrasting/supporting, identities. The project was guided by lessons learned in a pilot study I conducted with Native Hawaiian members of the science community as part of my Master’s Degree and is informed by philosophical concepts of multiple identities and cosmopolitanism (Appiah 2006, Sen 2006, Taylor
as well as intersectionality (Abes, Jones, and McEwen 2007, Jones 2009, Jones and McEwen 2000) as discussed in Chapters 1 and 2. This study was also guided by similar narrative research with Native Hawaiians both in (Chinn 2002, 2007b) and out of science (Ah Sam and Robinson 1998, Meyer 1998a, Stender 2010) and other minority groups in the sciences (Brotman and Moore 2008, Chinn 2002, McKinley 2005a, Stewart 2008) aided in the creation of four overarching research questions.

The guiding research questions for this project are:

1. What is the lived experience of identity construction and negotiation when multiple identities (Hawaiian and Scientist) are considered?
2. How is/are identity(ies) experienced and constructed?
3. What are the sociocultural/historical/political contexts that influence and shape identity?
4. What are the personal, social, and professional contexts that influence identity salience?

**Theoretical Framework**

Addressing the research questions required so-called Western qualitative research frameworks to be combined with Indigenous methodologies to create a paradigm that supports pluralistic epistemologies, Native Hawaiian ways of knowing, and the value of voice and narrative. This qualitative research used a constructivist grounded theory/critical case study lens. These frameworks work together to challenge positivist notions of a priori research, determinism, reductionism, exogenous research, emphasis on etic/objective viewpoints, and the ontological assumption of a single reality. Instead, grounded theory, case study, and indigenous methodologies link this project to others coming from a post-positivist perspective that emphasizes inclusion, an *emic, a*
posteriori, and endogenous\textsuperscript{36} approaches to research, the conceptual/temporal/contextual reality of human knowledge(s), the importance of human interaction(s), and the existence of multiple realities (Lincoln and Guba 1990).

Using these frameworks, oral histories were collected with an eye to how knowledge and realities are formed and are products of their cultural context be it Western Euro-American or Native Hawaiian, what these knowledges and realities mean to the individual participants, and how they relate and connect to each other to create an overall picture of identity salience among Native Hawaiian members of science community. Generally speaking, this research project will follow a method described by Yin (2009) and outlined graphically in Appendix E.

Since both grounded theory and case study tend to be “catch all” terms within the qualitative research community (Bogdan 2003, Creswell 2007, Seidman 2006, Taylor 1984, Yin 1994) it is important to have a clear understanding of what these frameworks imply, involve, and their potential impact on this research project.

**Grounded Theory Framework**

The grounded theory framework for the project placed me, as the investigator, in a central but not solo role as the primary instrument of data collection and analysis. That being said, the participants also played an important role in analysis throughout this process beyond a role of mere narrators. This portion of the framework and process “assumes an inductive stance and strives to derive meaning from the data” (Merriam 2001). Grounded theory research induces a “theory” that is grounded in the data (\textit{a posteriori}) as opposed to a deductive/quantitative investigation seeking to support or negate a theory or hypothesis (\textit{a priori}). While both qualitative and quantitative research involve some amount of “theory,” “no a priori theory could anticipate the many realities
that the inquirer will inevitably encounter in the field, nor encompass the many factors that make a difference at the micro (local) level” (Lincoln and Guba 1990). As a social constructivist grounded theory framework this research project emphasizes “diverse local worlds, multiple realities, and the complexities of particular worlds, views, and actions” (Creswell 2007, 21). An interpretive approach to research is at the heart of this framework – meaning “it recognizes the self-reflective nature of qualitative research…and emphasizes the role of the researcher as an interpreter of the data and an individual who represents information” (Creswell 2007, 248) with flexible guidelines, a focus on learning from the networks, situations, relationships, views, values, beliefs, feelings, assumptions, ideologies, and opportunities embedded within the participants’ experiences. Research questions within this framework “focus on understanding how individuals experience the process and understanding the steps in the process (i.e. What was the process? How did it unfold?)” (Creswell 2007).

**Case Study Framework**

The data in this investigation are oral histories (OHA 2000, Yow 2005) of ten (10) Native Hawaiian members of Hawaiʻi’s STEM community. The method used to gather data was through case study analysis. Definitions as to what a case study is differ. Yin (1994) defines it in terms of process; “a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context” (13). Stake (1995) and Wolcott (1992, 2001), on the other hand, focuses on its end product: “A qualitative case study is an intensive, holistic description and analysis of a single instance, phenomenon, or social unit” (Merriam 2001). Lincoln and Guba (1990) note that definitions range from the simplistic “slice of life or a depth analysis of an instance to
more formal statements as Denny’s (1978) ‘intensive or complete examination of a facet, an issue, or perhaps the events of a geographic setting over time’” (360).

Although there are differences, the basic idea regarding case study research is that it is “a methodology, a type of design in qualitative research, or an object of study, as well as a product of the inquiry” (Creswell 2007, 97). As with any research design, case studies come with their own inherent strengths and limitations. The case study approach offers a means to investigate complex social situations comprising multiple variables of social/psychological/cultural importance in understanding a particular phenomenon anchored in the real-life situations and experiences of the narrators. It results in rich and holistic accounts of the phenomenon and offers insights and illuminations that can be interpreted as tentative hypotheses that can help guide future research.

This research called for the use of a multiple-case study framework. The design explored individual cases and generated cross-case analysis. Multiple-case studies, such as this, have increased in popularity in fields such as anthropology, education, and political science because of their ability to emphasize both the individual case and be “comparative.” In general, a case study framework enabled me to work with individual participants, collect rich data in the form of oral histories, compare those narratives to each other, analyze the collective experiences, and make some participant-specific as well as general statements.

The incorporation of Indigenous methodology into this research project had two effects. First, it represented the cultural heritage of the participants as members of Hawaiʻi’s Native Hawaiian community. Secondly, it recognized the importance of Native perspective and its connections and similarities to so-called Western qualitative
theoretical frameworks while acknowledging the Native perspective as different and unique from these so-called Western perspectives.

**Indigenous Methodology**

The aforementioned frameworks were co-mingled with Indigenous methodologies, particularly those advocated by Smith (2004), Kovach (2009), Denzin, Lincoln, and Smith (2008), and Wilson (2008) as a way to stay true to the nature of the participants and the culture they represent. Any integration of both so-called Western and Indigenous research/conceptual frameworks must contain several key qualities as outlined by Indigenous scholars including: holistic epistemology, story, purpose, the experiential, tribal ethics, tribal ways of gaining knowledge, and an overall consideration of the colonial relationship. The coalescing of these research frameworks also requires us to look at traditional research paradigms (i.e. ontology, epistemology, axiology, and methodology) through a “native” lens. As I explained in Chapter 1, the Indigenous “worldview is based on an alliance and alignment of elements and that there must be constant communication between the (Natural, Spiritual, and Human) realms to maintain this delicate balance” (Kawagley 2006, 14). This same worldview applies to research. “Rather than thinking about these four separate ideas or entities,” Wilson (2008) prefers “to think of them in a circle (Figure 11) where the entire circle is an Indigenous research paradigm” (70).
This paradigm, as Wilson further explains, is “based upon a process of relationships that form a mutual reality (ontology and epistemology)…and maintaining accountability to these relationships (methodology and axiology)” (71). Building upon the relational aspect of the Indigenous research paradigm is a larger framework from which to view not only these four entities, but research with Indigenous people as a whole (Figure 2). This framework links the four previously mentioned research entities (axiology, ontology, methodology, and epistemology) with other aspects of research including researcher and research preparation, decolonizing and ethics, gathering knowledge, making meaning, and giving back.
Mixing Methodologies

As clarified by Smith (2004) “the mix (of methodologies) reflects the training of indigenous researchers which continues to be within the academy, and the parameters and common sense understandings of research which govern how indigenous communities and researchers define their activities” (143). The history of Native Hawaiians is told through both a Native and Non-Native lens of colonization and marginalization. As such, Indigenous methodologies both within “involve the processes of transformation, of decolonization, of healing and of mobilization. These processes, approaches, and methodologies – while dynamic and open to different influences and possibilities – are critical elements of a strategic research agenda” (Smith 2004, 116). While the combination and integration of these methodologies seem like a natural fit, Kovach (2009) points out “there are at least two fundamental difficulties in presuming qualitative research, a Western tradition, can fully bring Indigenous methodologies under its wing” (30).

The first has to do with language. Since so much of what a culture is (or was) is tied up in its language it is difficult for both Indigenous and non-Indigenous people to express native/tribal knowledges and realities if they do not speak their traditional language. The
second challenge relates to knowledge itself. “Indigenous methodologies are guided by tribal epistemologies, and tribal knowledge is not Western knowledge” (Kovach 2009, 30). As a result of these challenges, and the trauma imposed on the Native Hawaiian people through colonization, research by, for, and with Native Hawaiians contains elements of decolonization (Chinn 2007a, Denzin, Lincoln, and Smith 2008, Laenui 2000, Maaka 2005, Smith 2004, Wilson and Bird 2005). This includes, but is not limited to, rediscovery and recovery, mourning, dreaming, commitment, and action (Laenui 2000). As research that may participate in the decolonization process, any and all social movement literature is relevant, firstly because education is a two-way path of empowerment and subjugation. Secondly, science education, particularly in the contexts so-called Western science as compared to Indigenous/Aboriginal knowledge and ways of knowing (Aikenhead 1999, Baker 1996, Belczewski 2009, Kana'iaupuni 2005), contributes needed elements of collective identity for members of the Native Hawaiian community and the greater local community as a whole.

As part of the decolonization process researchers engaged in Indigenous research have called on one another to formally separate from Western research traditions and to engage in research solely through their own Indigenous lens and methodologies (Meyer 1998b, Wilson 2008). However, these Native scholars also realize that in order to graduate with degrees, function, and influence policy in the “mainstream” culture requires an alliance of sorts between both so-called Western and Native methodologies. Kovach (2009) explains:

At present, there is a desire to give voice to Indigenous epistemologies within qualitative research, yet those who attempt to fit tribal epistemologies into Western cultural conceptual rubrics are destined to feel the squirm. From my perspective, Indigenous methodologies and qualitative research at best form an insiders/outside relationship. The tension of the insider/outside dynamic will persist until Indigenous research frameworks
have methodological space within the academic research dialogue, policy, and practice (31).

![Figure 13: Locating Indigenous methodologies in/with qualitative research (Kovach 2009, 33).](image)

Although there may be some conceptual and theoretical “squirming,” I feel the combined Indigenous/Grounded theory/Case study framework compliment each other well. As a combined framework, this lens assumes Hawaiian methodologies co-exist with other methodologies and therefore mirrors the co-existence of plural identities in each of the participants, particularly scientist/science teacher identities. Lastly, this framework will help to address several key questions raised by Wilson (2008) for those contemplating Indigenous research and/or at various stages in the research process: How do my methods help to build respectful relationships between the topic that I am studying and myself as researcher? Do my methods help to build respectful relationships between the research participants and myself? What is my role as researcher in this relationship, and what are my responsibilities? Am I being responsible in fulfilling my role and obligations to the other participants, to the topic and to all my relations? What am I contributing or giving back to the relationship? Is the sharing, growth, and learning that is taking place reciprocal? Questions relating to my role as researcher will be addressed later in this section.
Oral Histories

Using grounded theory/case studies as a way to gather oral histories provide me with a glimpse into the life and reality of the participants as they continuously sought to find a balance between the pluralities and salience of their personal identity. This constructivist methodology emphasizes the way humans experience the world and the stories that they tell (Smith 2004) and parallels the Hawaiian value of interconnectedness. People are not independent of the world around them and that we have an effect upon everything we come in contact with physically, emotionally and spiritually. Although I refer to this process as collecting oral histories, this term can also be used interchangeably with life history, self-report, personal narrative, life story, oral biography, memoir, and testament. In this vein, I use the terms participant(s) and narrator(s) interchangeably throughout Chapters 4 and 5.

As the primary researcher, I was involved in framing the topics and inspiring the narrators to begin the act of remembering. Other terms for this process include in-depth interview, recorded memoir, life history, life narrative, taped memories, and life review are also appropriate (Ives 1974, Lincoln and Guba 1990, Patton 1990, Yow 2005). The gathering of personal reflections and narratives of events, their causes, and effects provides a contextual focus common to qualitative research, particular in the field of education. This approach is both a product and a process (OHA 2000, Creswell 2007, Yow 2005). “It is a study of stories or narrative or descriptions of a series of events that accounts for human experiences” (Creswell 2007, 150). “What distinguishes the narrative,” according to McEwan and Egan (1995), “is that it takes shape...as a rhythm that ultimately springs from patterns implicit in human life and action” (vii). As such it
has the potential to make important contributions to educational, psychological, and sociological discourse.

The overall purpose of collecting an oral history is to generate a representation of the participants’ reality relating to a particular phenomenon. Just as this research sought to uncover details relating to identity salience, Lincoln & Guba (1985) assert that reality might exist at any of one of four levels: objective reality\(^3\), perceived reality\(^4\), constructed reality\(^5\), and created reality\(^6\). Whereas oral histories give us an opportunity to catch a glimpse of the reality of the narrator herein lay the potential difficulties—the accuracy of the participants’ memories and the coherence of their reality. Yow (2005) explains the “ability to recall depends on the individual’s health, on the topic under consideration, on the way the question is asked, on the degree of pain (or pleasure) required to dredge the topic up, and on the willingness of the narrator to participate in the interview in a helpful way” (20). The more significant the event or situation is to the individual the more likely it is to be remembered in some detail, especially if the feelings were intense and produce a coherent autobiography (Landau 2009a, Yow 2005). As my father would say, “we can remember the story we want to tell, but we can’t remember how many times we’ve told it to the same person.”

What happens if the narrators are “wrong” regarding the information they share? First of all, this particular research project is not dealing specifically with the recollection of a historical event. Therefore, the recollection of an incorrect date will not affect the importance of their oral histories or the significance of the event as it relates to their identity. Secondly, one of the strengths of oral history research is that even “‘untrue’ (false beliefs) statements are psychologically ‘true’ and that errors in fact may be more
revealing than factually accurate accounts” (Yow 2005, 22). Portelli (1981) insists that the “importance of oral testimony may often lie not in its adherence to facts but rather in its divergence from them, where imagination, symbolism, and desire break in” (37). Not only does this attitude toward memory match aspects of the aforementioned so-called Western (i.e. constructivist and the existence of multiple realities) and Indigenous methodologies (meaning making and interactions) it also parallels the TMT concept of memory making as a buffer against anxiety (Greenberg 1990, Landau 2009c, a, Rosenblatt 1989). Ives (1974) and Yow (2005) reminds us that oral history is inevitably subjective but this subjectivity is critical to understanding the meanings we give our past and present and use to guide us in the future.

**Interviews**

Lincoln and Guba (1985) describe the interview process as a series of important (though non-linear) steps “that must be accounted for at some point in the process—and often more than once as recycling and reiteration occur” (322). Steps included deciding on whom to interview (purposeful selection), preparing for the interview (practicing interview questions and technique), initial moves (warming up the narrator before the “official” interview begins), pacing the interview and keeping it productive, and terminating the interview and gaining closure (when the information becomes redundant and/or both interviewer and narrator display fatigue).

Seidman (2006) recommends that each participant’s oral narrative take place during three one-hour semi-structured interviews. However, I decided very early in this project to include a fourth, and in some cases a fifth, informal interview with each of the participants prior to the official recorded interviews. “Talking story” prior to the official interviews gave both the narrators and myself the opportunity to get to know each other
and address any questions, comments, or concerns regarding the project. I felt that this was especially important given the ethnic insider/outsider nature of this research project. Because the community in Hawai‘i, particularly the science community, is so small each of the narrators and I realized quickly that we know a lot of the same people. This provided an immediate personal connection between us beyond our interest in STEM-related fields. Additional connections were made with regards to family situations, graduate school experiences, and hobbies and interests that provided additional dimensions of connection. For example, Kahelelani, Kaipo, Lawai‘a and I, as PhD students, celebrated and lamented the rigors of graduate school. Keala, having grown up and gone to school on the Leeward Coast, knew some of the teachers I had worked with when I taught at Nānākuli High and Intermediate School.

Due to the size of the science community in Hawai‘i and how easily I was able to make connections with each of the participants, both Dr. McEwan and I felt the anonymity of the participants could be compromised if the full transcripts were published in this dissertation. For that reason, Chapter 4 contains only excerpts from each of the interviews. This provides an additional level of anonymity protection for the participants, their friends, and families and allowed the participants to speak more freely about their experiences.

One of the most consistent questions from the participants while talking story with them was in regards to how I planned to share my findings. I explained to each participant that I plan to share the findings of this project with everyone and anyone who might be interested. That includes the university, other researchers, organizations that focus on STEM-related activities and education, organizations that work primarily and/or
exclusively with Native Hawaiians, and especially those that support Native Hawaiian students and other underrepresented groups interested in pursuing degrees and careers in STEM-related fields. Knowing this made many of the participants feel much more comfortable about the project because they knew that their experiences could help others in future. This theme of the importance of community is expanded upon in Chapter 4.

The first official interview focused on life context and life history. This interview included questions about parents, community, neighbors, home life, cultural upbringing (i.e. food and language), childhood, schooling, movement and early employment. The second built on the biographical background from the previous interview and focused primarily on areas of expertise. This interview focused on what the participant is presently doing; addressed the question “how and why did you decide to…” as it relates to their professional lives, and explored details of their experiences in professional life. The third interview allowed us to reflect on meaning. This final interview created a time and place to invite each of the narrators to reflect and make sense of their personal and professional lives, to address the question “What does it mean to be…” as well as reflect on the themes they have talked about and/or that others have talked about. The semi-structured protocol was used as a guide to maintain consistency throughout the data gathering process. However, each subsequent interview (and the questions used) with each participant was based on the information they provided during their previous interviews. As such, specific aspects of each interview were different while the overall framework, guided by the protocol, remained the same.

Interviews were digitally recorded with permission from the participants (see Appendix D). Questions sought to explore participants’ life-span development while
giving them the opportunity to consciously reflect on past events without trying to reinvent it to give meaning to one’s present (Huberman 1995). To this end, this study utilized facets of several projects outlined by Smith (2004) including, but not limited to, indigenizing, story telling, reframing, protecting, and discovering. In addition to the interviews, notes were also taken regarding non-verbal cues throughout each of the three interviews. These included, but were not limited to, meaningful pauses, crying, gestures, body language, touching, pacing, and smiling. These non-verbal cues added depth to the already rich data each participant provided and have been included in certain excerpts in Chapter 4.

**Access to Participants**

As a non-Hawaiian researcher performing research with Native Hawaiian participants the guidelines and best practices in this section were followed while keeping in mind my role as an outsider (etic) looking in (emic) (Innes 2009). There are two main issues that could have arisen as a non-Hawaiian working with Hawaiian participants: bias and access (Innes 2009, Kovach 2009, Smith 2004, Wilson 2008). Throughout the research process it was very important for me to be aware of my own social/cultural/historical biases and work to ensure that these biases were minimized during the interview process, when coding for themes, and making connections between the participants. Regular member checks and outside readers have helped to ensure quality and validity of the interviews and the themes gleaned from them. Additionally, both the member checks and outside readers have helped ensure that each of the narrators has been represented fairly, honestly, and ethically (Bogdan 2003, Creswell 2007, Lincoln and Guba 1990, Seidman 2006, Taylor 1984).
Being an ethnic/cultural outsider access to Native Hawaiian members of the science community could have been an issue. Luckily I had a great deal of help from a variety of gatekeepers (Charmaz 2011, Creswell 2007, Lincoln and Guba 1990, Merriam 2001, Seidman 2006, Yow 2005). These individuals helped introduce me and granted me access to Native Hawaiian members of Hawai‘i’s STEM community. These gatekeepers included members of public, private, and charter schools, colleagues, members of scientific organizations, business leaders, and members of Native Hawaiian organizations. Lincoln and Guba (1985) explain that “in most cases…gatekeepers will want to be informed about the inquiry in ways that will permit them to assess the costs and the risks that it will pose, both for themselves and for the groups to which they control access” (253). After explaining the purpose of the project several of these individuals became participants in this project. Others acted as “gatekeepers” and facilitated face-to-face and digital introductions with individuals and groups of Native Hawaiian science students and scientists.

In addition to utilizing gatekeepers to make purposive selection of participants, I also relied on social media outlets such as Facebook and Twitter to make inquiries within both scientific and Native Hawaiian organization with which I had no previous contact. In all of these instances, I introduced myself and spoke of this project in an honest and upfront way. All individuals interested in participating were directed to take a brief survey on the Internet that provided me some basic biographical information (name, age, level of education, gender, location, degree/profession). These responses enabled to me to purposefully select individuals for this research project who would be a representative as possible of both the Native Hawaiian and science communities.
Participants

The participants are all of Native Hawaiian ancestry and currently involved in Hawai‘i’s scientific community. Participants included undergraduate and graduate students in STEM-related fields of study, science teachers/professors, scientists, science lobbyists, and individuals working for/with STEM-related programs. All of the participants were over the age of eighteen and living in the state of Hawai‘i during the time of the interviews.

Procedures were constrained by such factors as the time in which to schedule and conduct interviews, the geographic location of the participants, and the financial resources required to meet face-to-face with participants. As a full-time teacher, I met with most of the narrators after school and during quarter and semester breaks. All but one of the participants lives on Oahu. This required a bit of driving. One participant lives on Maui. This particular participant and I, however, were able to talk story and get acquainted on Oahu, though all three of the official interviews took place on Maui. While this did cause me extra expense, I felt that the insights and experiences he could provide as part of this project were invaluable.

Bounding the Case

One of the defining characteristics of a case study is the boundary that encompasses the phenomenon that is being studied. Although this is a narrative study, there are certain factors that defined the boundaries of this case. Interviews with participants took place during the course of the 2011-2012 calendar year as specified by the Institutional Review Board (IRB) of the University of Hawai‘i at Mānoa (UHM). Each participant was interviewed at least three times following the format outlined in Data Collection using the protocol in Appendix A. Every effort was made to conduct interviews within two weeks
of each other. However the reality of life, including travel, midterm and final exams, and family emergencies, led to delays in the interview process for some of the narrators and, in one case, the discontinuation of the interview process prior to its completion. Other challenges included miscommunications between participants and myself, and missed appointments. In one case, the participant completely terminated all communication with me following the third interview.

All of the participants were eighteen years or older, currently living in the State of Hawai‘i (on Oahu and Neighbor Islands) and currently employed in a STEM-related field in the State of Hawai‘i. Sampling for this research was purposeful with participants chosen to gain as much representation as possible of the broad spectrum of both the science and Native Hawaiian communities. This includes, but is not limited to, age, educational background, and socio-economic status as well as science content areas (i.e. life sciences, engineering and physical sciences) and experiences. The ages of the participants ranged from 22 to 50 years old with an average age of 35.9 years old. Participants included three individuals who received their college education outside of Hawai‘i including two who also attended community college. Participation was split between public and private schools for secondary school with four of the ten participants attending Kamehameha Schools at some point during K–12.

**Documentation**

Records of the interactions between myself and each of the participants will be kept using Participant Data Sheet and Master Log adapted from Ives (1974) and Yow (2005) and found in Appendices 2 and 3 respectively. Documentation in relation to this research includes dates of initial contact letters/emails, interviews, member checks, edits and
rewrites, and proofreading. These record-keeping methods helped me to stay organized while interviewing, transcribing, coding and member checking thirty separate interviews. They also helped to ensure that the participants were part of the process and retained ownership over their life story.

Data Analysis
Each digitally recorded interview was transcribed with the assistance of Express Scribe software. Following transcription, I e-mailed copies of raw transcripts to each of the participants. This allowed them to make corrections, changes, provide clarifications, as well as add and/or remove information from the written record. Transcripts were then coded for themes linking the participants and to glean meaning from their collective narratives. As themes developed, they were shared with the participants as part of the third interview. Following all of the interviews and editing, all three edited interviews were merged to create a coherent narrative based on each of the participants’ experiences.

The draft narratives ranged in length from 25 to 40 pages and were shared with each of the participants respectively. These narratives were also shared with Dr. McEwan so both he and I could confer on emerging themes. The sharing of this final narrative once again gave narrators the opportunity to expand, reflect, and edit the final product that would be used for this dissertation.

The original intent of this project was to share all of the narratives with all of the participants and to include them in this dissertation. However partway through this project the participants, Dr. McEwan, and I became concerned that the anonymity of the narrators could not be maintained if the full transcripts were shared. This was due to the fact that the number of Native Hawaiians involved in Hawai‘i’s STEM community is so small. Therefore, the decision was made to share the narratives with the narrators to
whom they belong and to include only excerpts in the analysis. Finally, a full list of themes gleaned from the interviews and were examined in Chapter 4 was e-mailed to the participants for their comments, thoughts, and suggestions. This inclusive step ensured the coding was accurate and the themes are both credible and reliable. After receiving feedback and approval from the participants, the themes were shared with my dissertation committee and expanded upon for Chapter 4 of this dissertation.

**Coding**

Merriam (2001) explains that “coding is nothing more than assigning some sort of shorthand designation to various aspects of the data so you can easily retrieve specific pieces of the data” (164). Designations can include a single word, phrases, letters, numbers, symbols or some combination thereof. “Grounded theory coding,” as explained by Charmaz (2011), “requires us to stop and ask analytic question of the data we have gathered” (42). “Coding gives the researcher a condensed, abstract view with scope and dimension that encompasses otherwise seemingly disparate phenomena” (Holton 2010, 266). Figure 11 shows coding levels – *initial/open, focused, and axial/thematic* – adopted and adapted from (National Science Foundation 2013) and used throughout this analysis of the participant data.
Material used in the coding process included, but was not limited to words, sentences, quotations, analogies, songs, and stories, including and especially those in languages other than English (i.e. Hawaiian, pidgin) as well as my own notes and observations throughout the interview process. Additionally, particular attention was paid to non-verbal cues (i.e. body language, laughter, sighing, tears, meaningful pauses and silence) as they relate to the overall context of individual interviews and themes as a whole. Throughout the coding process I made extensive use of memoing or “notes about the data and the conceptual connections between categories” (Holton 2010, 281). A continual process that ran parallel with coding analysis, memoing helped me develop and understand the properties of each category individually and collectively and raise the data to a conceptual level.

Initial or open coding (coding the data for its major categories of information) in this project stuck close to the data and tried to see actions in each segment of data rather than applying preexisting categories to the data (Charmaz 2011). My initial coding was based
on a variety of literal, figurative, and contextual material provided by each of the
participants that included a mix of word-by-word,\textsuperscript{53} line-by-line,\textsuperscript{54} incident-to-incident,\textsuperscript{55}
and \textit{in vivo}\textsuperscript{56} coding methods.

Following transcription of each interview, the transcript and field notes were
reviewed and coded so it could be accessed later during the analysis and write-up.
Merriam (2001) and Wolcott (2001) note that while this step is simple, it is often
overlooked because the interviewer usually feels there is no way they could forget where
and when an incident took place and the characteristics of the person that was just
interviewed. The reality is that we are likely to forget identifying characteristics of an
interview very soon after the interview takes place let alone ten interviews later with
three other narrators. Keeping this in mind I strove to transcribe and begin the coding
process as quickly as possible after each of the interviews with the participants.

The initial open coding revealed several major themes, which were then subjected to
the second major phase of coding that focused the most significant and/or frequently
occurring codes. This helped me determine the adequacy of the previous codes and
which codes make the most analytic sense so I could categorize my data incisively and
completely (Charmaz 2011). The initial and focused coding phases yield five major
themes: identity salience, personal/cultural connections to science, a Hawaiian doing
things vs. doing Hawaiian things, first generation Native Hawaiian scientist, and being
uniquely Hawaiian.

Categories were created for each of the core phenomenon creating specific links
between participants referred to as axial coding\textsuperscript{57} (Creswell 2007, Lincoln and Guba
1990). Within each category, several \textit{properties}, or subcategories were found. Charmaz
citing Strauss (1987) “views axial coding as building a ‘dense texture of relationships around the “axis” of a category’” (65). As analysis continued into the second and third interviews for each participant I looked for data to “dimensionalize,” or show possibilities of particular properties. During this stage, I sorted, synthesized, and organized large amounts of data and assembled and reassembled the data in new ways including visual models such as those in Figure 12. This helped me to identify and focus on central phenomena and explore causal conditions that influence the phenomena, strategies (actions or interactions that influence the phenomenon), context and intervening conditions (the narrow and broad conditions that influence the strategies), and consequences (the outcomes of the strategies) for the phenomena. It also enabled me to choose excerpts from the individual narratives that best conveyed thematic layers that emerged during the individual and collective interview process.

Axial coding revealed underlying links between groups of individuals within a broad theme. For example, initial and focused coding revealed similar experiences among all of the narrators as one of few, if not the only, Hawaiians in science. Axial coding,
however, uncovered specific gender-based themes within this particular phenomenon. Both initial and axial codes were marked/highlighted on both digital and hard copies of the merged narratives so they could be linked together during the analysis of this research project in Chapter 4.

There are a variety of computer programs that assist in coding qualitative research projects however, I chose to code by hand. The process was certainly daunting given the thirty separate interviews that needed to be read and reread to code accurately for individual and collective themes. The primary method of coding for this project could be considered open/thematic coding in that I looked for common words, phrases, ideas, and concepts that were interwoven into the experiences of multiple participants.

To verify the accuracy of the themes garnered from the participant’s stories and experiences the members of my dissertation committee, particularly my advisor, Dr. Hunter McEwan, acted as outside readers. In this way I hope to present the experiences of the participants in a meaningful and respectful manner that weaves them together into a cohesive phenomenon while searching “for contextualized realities and acknowledg(ing) many truths” (Kovach 2009, 27). Additionally, both the open and axial themes were shared with the participants with many commenting how the themes, and thus the collective experiences, accurately mirrored their own personal experiences as a Native Hawaiian member of Hawai‘i science community.

**Role of the Researcher**

Before closing out the theoretical framework section of this chapter there are several questions regarding my role as the researcher in this project that I wish to address: How did my methods help to build respectful relationships between the topic that I am studying and myself as researcher? How did my methods help to build respectful
relationships between me and the other research participants? What was my role as researcher in this relationship, and what are my responsibilities? Was I being responsible in fulfilling my role and obligations to the other participants, to the topic and to all my relations? What did I contribute or give back to the relationship? Was the sharing, growth, and learning that is taking place reciprocal? In this section I will use these questions as a guide to address what my role as researcher was for this project in general as well as my specific role with regards to a non-Hawaiian performing research with and for Native Hawaiians.

Generally speaking, my role as researcher was to create, nurture and sustain a positive social relationship between myself and the participants during and following this project (Charmaz 2011, Kovach 2009, Merriam 2001, Seidman 2006, Wilson 2008). As a researcher participating in the oral history process and product with human subjects, Institutional Review Board (IRB) approval was sought to ensure the process I used meets with Federal standards of ethics, safety, and excellence. In fact, the personnel at UHM’s IRB were very responsive to questions and issues that came up during the research process, particularly when one participant ceased all communication after the completion of our interviews. I also looked to the general principles and best practices as outlined by the Oral History Association (2000) to guide me and make certain that I upheld the principles, professional and technical standards, and obligations as befitting an oral historian. These included, but were not limited to, ensuring that narrators voluntarily gave their consent to be interviewed (and withdraw or refuse at any time) and that the narrators reserve the right to add, delete, and edit their transcripts during the interview process, creating and maintaining mutual respect for the interview process, striving for
intellectual honesty while avoiding stereotypes, misrepresentations, or manipulations of the narrators’ words, understanding that oral history interviews are historical documents adding to the greater body of knowledge and are therefore accessible to future researchers and members of the public, using the best equipment possible to record interviews, and taking care not to make promises that cannot be met. These principles, and others outlined by the Oral History Association, were followed when selecting participants, during pre-interview phone/email introductions, talking story sessions, the three-stage interviews, and post-interview/analysis.

**Validity and Reliability**

It was personally, professionally, and culturally vital that steps were taken to treat each participant, their ike, and mana‘o they shared through their personal narrative with respect. Just as they would be with any research, ensuring validity, reliability, and maintaining ethics are paramount to this project. Quantitative and qualitative research projects address issues relating to validity and credibility through different techniques. In both quantitative and qualitative research, the researcher looks to ensure that conclusions rest upon the data collected during the investigation. The credibility of that data, however, depends on how it was collected. In more quantitative/experimental research, researchers are concerned with issues pertaining to instrumentation, appropriateness of the data analysis techniques, the degree of relationship between the conclusions drawn (Charmaz 2011, Creswell 2007, Creswell and Plano Clark 2007, Lincoln and Guba 1990, Wolcott 2001, Yow 2005, Bryant and Charmaz 2010) to ensure their data is both valid and reliable. On the other hand, in qualitative research researchers ask questions pertaining to the construction of narrative data and whether the contents of documents
used in the construction of the narrative were properly analyzed to ensure their credibility (Merriam 1998).

Lincoln and Guba (1990) note that “in an experimental study you can talk about the validity and reliability of instrumentation, the appropriateness of the data analysis techniques, the degree of relationship between the conclusions drawn and the data upon which they presumably rest” (378). A qualitative research is not much different. As the primary researcher I had to ensure that the interviews were reliably and validly constructed, the content of the documents properly analyzed, and that the conclusions of the case study rest upon the data. Merriam (1998) remarks, “more recent writing from postmodern, post-structural, constructivist, and critical perspectives call for the careful thinking through of totally different conceptualizations of validity and reliability” (198). Lincoln (1990) and Wolcott (1992, 2001) suggest that the emerging criteria for quality be based on the relational aspects of the research process as well as critical elements in the data itself and finding plausible interpretations from them. Indigenous research paradigms provide an additional layer to this discussion as Indigenous researchers look to validate their findings from within the Indigenous paradigm (Chinn 2007b, Kovach 2009, Laenui 2000, Maaka 2005, Smith 2004, Wilson and Bird 2005, Wilson 2008). While research communities struggle to reach a theoretical and philosophical consensus to ensure validity, qualitative researchers face an immediate need in the field. The following sections of this chapter address some specific methods I used throughout this project with respect to internal validity, reliability, and external validity.

**Internal Validity**

Internal validity, according to Merriam (2001) “deals with the question of how research findings match reality (and) how congruent the findings are with reality” (201).
Recalling the combined grounded theory/case study/Indigenous framework for this study, how are we to measure reality in a framework that assumes, acknowledges, and supports the existence of multiple realities? Lincoln (1990) explains that because reality is a mental construction made by humans and “since human beings are the primary instruments of data collection and analysis, we are thus “closer” to reality than if a data collection instrument had been inserted between us and the participants” (Merriam 2001, 203). One of the underpinnings of this research project and all qualitative research, in general, “is that reality is holistic, multidimensional, and ever-changing; it is not a single, fixed, objective phenomenon waiting to be discovered, observed, and measured as in quantitative research” (Merriam 2001, 202). Despite these understandings and philosophical underpinnings, it is necessary to provide current and future readers with a sense that this research is valid.

Internal validity was ensured primarily through three methods – member checks, multiple data sources, and peer review (Bryant and Charmaz 2010, Charmaz 2011, Greene 2007, Lincoln and Guba 1990, Merriam 2001, Yin 1994). As each of the three segments of the interview process and transcription were completed, participants (members) were given the opportunity to read and review their interview. Transcripts were exchanged via email as many times as was needed for each participant to feel that it accurately represented their voice and experiences. This important step enabled participants to add, edit, and/or remove portions of their narrative if needed. During the later stages of data analysis, participants were also invited to read and comment on the emerging themes. Involving participants in these steps ensured accurate representation of their experiences and reinforced empowerment by giving them control of their stories.
The second method I used was the collection and analysis of multiple data sources. Interviews tell the bulk of the story and are central to answering the research questions. However, they are still only one part of the reality of being a Native Hawaiian member of the scientific community. In addition to interviews, non-verbal observations made during interviews and other documents (curriculum, journal articles, books, English and Hawaiian language newspapers) were used. These sources, in addition to interviews, provided three perspectives of the same events. With three data sources, each from a different instrument, the chance of one-sided data is greatly reduced (Merriam 2001).

Finally, Dr. McEwan read the transcripts and findings from the participant interviews. As an outside member, Dr. McEwan not only provided additional perspectives on the themes gleaned from the participants’ narratives, he also helped me ensure that my interpretation of the narratives is clear, honest, respectful, and accurate. While I have brought my personal experience and biases to this research project, having an outsider read the analysis helped verify my finding and minimize by own biases (Lincoln and Guba 1990, Merriam 2001, Seidman 2006, Yow 2005).

In addition to these three methods, Lincoln and Guba (1990), Seidman (2006), and Merriam (2001) also recommended taking time to clarify the researcher’s assumptions, worldview, and theoretical orientation both before, during, and the outset of the study. This step was especially vital as a non-Hawaiian researcher conducting research with Native Hawaiians (ethnic outsider – ethnic insider) (Kovach 2009, Smith 2004, Wilson 2008). Although the spirit of this research project is to embrace the plural identity model and look beyond singular compartmentalized identity definitions, the non-
Hawaiian/Hawaiian cultural dynamic of this research is an important factor to consider throughout this project.

**Reliability**

Maintaining a high standard of quality is important for any research project. In experimental projects, reliability is often connected with internal validity and refers to the extant to which the results of the research can be replicated and whether it will yield the same results (Greene 2007, Patton 1990, Yin 1994). In other words, how transferable is the data? Are similarities or differences in data sets “A” and “B” statistically significant and are they representative of the population as a whole?

This narrow conception of reliability (and reality) is problematic for narrative based projects. Firstly, it is based on the assumption of a single reality. Secondly, it further assumes that this reality can be replicated by studying it repeatedly. Lastly, it does not take in to consideration a conceptual framework composed of multiple realities that are themselves fluid, dynamic, and ever changing. Perspective is never static and qualitative research is not conducted to isolate individual laws of human behavior. Therefore, as a qualitative researcher, I will instead seek to describe and explain the world as those in the world experience it. “Because what is being studied,” as Merriam (2001) explains, “is assumed to be in flux, multifaceted, and highly contextual, because information gathered is a function of who gives it and how skilled the researcher is at getting it, because the emergent design of a qualitative case study precludes a priori controls, achieving reliability in the traditional sense is not only fanciful but impossible” (5). Because of the interpretive nature of qualitative research, replication will not yield the same results - topic I come back to in Chapter 5.
How then, can I ensure the data I collect and the analyses made from that data are “reliable?” Bogdan (2003), Greene (2007), Lincoln (1990), Merriam (2001), Wolcott (2001) and Yin (1994) offer several suggestions. The first, as offered by Merriam (2001) is to stop thinking of reliability in the “traditional” sense. “Rather than demanding that outsiders get the same results, a researcher wishes outsiders to concur that, given the data collected, the results make sense—they are consistent and dependable” (205). Techniques to ensure reliability include clarification of the investigator’s position in the research, *triangulation* (including member checks, multiple methods of data collection, and peer review), and an *audit trail* – detailed descriptions of how the data will be collected, how categories were derived, and how decisions were made throughout the project. Yin (1994) describes this process as conducting research as if someone were always looking over your shoulder. To aid both participant and peer review of this project I have developed an overarching flowchart (Appendix G) outlining the steps I used in the research project. Additionally, I developed and used record keeping methods adopted and adapted from Ives (1974), Lincoln (1990), Merriam (2001), and Seidman (2006) including a narrator data sheet (Appendix D), a spreadsheet of biographical information of the narrators (Appendix E), and a master log of the project (Appendix F).

Using these methods I collected ten oral histories, analyzed them, and in the following chapter present themes gleaned from cross-case analysis of the participants’ statements. Throughout the research I have done my best to represent the multiple constructions (participant realities) and reconstructions (findings and interpretations) adequately, respectfully, and in a way that will be credible to the constructors of the

**External Validity**

There is a trade-off in terms of the criterion for testing validity when it comes to qualitative research, particular that which is narrative-based. The conventional framework for internal validity hinders the holistic, dynamic, and contextual nature of the data being collected and prevents clean generalizations. Lincoln (1990) explains that external validity falls victim to the same issue as internal validity—assumption of a single reality. Qualitative researchers struggle with traditional conceptions of external validity because of the nature of the data they collect. Whereas internal validity/reliability dealt with the question of whether data and conclusions are transferable, external validity has to do with whether they are generalizable. In experimental research, the ability to generalize to other settings is ensured through a hypothesis and a priori conditions (independent/dependent variables, controls, sample size).

While the criteria for ensuring external validity may be different for qualitative research, the goal of producing generalizable knowledge is an appropriate goal. Both Lincoln (1990) and Merriam (2001) refer to this as naturalistic generalization—where people look for patterns based on their own experience, tacit knowledge, and intuition. Merriam (2001) also refers to reader or user generalizability and what Firestone (1993) calls case-to-case transfer. Rather than me, as the researcher, making generalizations about how the experiences of the ten individuals in this project tell us about all Native Hawaiians, scientists, or scientists of Native Hawaiian ancestry, Merriam, citing Firestone, explains, “it is the reader who has to ask, what is there in this study that I can
apply to my own situation, and what clearly does not apply?” (211). Creswell (1998), Lincoln (1990), and Merriam (2001) contend, “that the researcher is less concerned with generalizing than the reader or user. Nevertheless, there is an obligation to provide enough detailed description of the study’s context to enable readers to compare the ‘fit’ with their situations” (ibid).

To enhance this possibility that results from this study can help develop working hypotheses, concrete universals, naturalistic generalization, or user generalization (Charmaz 2011, Creswell 2007, Denzin, Lincoln, and Smith 2008, Lincoln and Guba 1990, Merriam 2001, Yin 1994), three strategies are suggested—*rich, thick description* so readers will be able to determine how closely their own situations match the research situation (Merriam 2001, Yin 1994, Yow 2005), *typicality or modal categorization* of how typical the individual is compared with other participants in the research so that users can make comparisons with their own situations (Lincoln and Guba 1990, Merriam 2001, Wolcott 2001), *multisite designs* meaning purposeful sampling of individuals to maximize diversity so the results can be applied by readers to a greater range of other situations (Creswell 2007, Merriam 2001, Seidman 2006, Taylor 1984).

The three previous sub-sections summarized three methods of “safeguarding” the passage of knowledge from writer to reader/user. This last section explains ways in which I safeguarded the passage of knowledge from the participant(s) to me, the researcher.

**Human Subjects**  
As with all research involving humans, Institutional Review Board (IRB) approval was sought before interviews with any participants will proceed (See Appendix B). To facilitate this process a summary of this proposal (abstract) was submitted along with the
research questions, interview protocol, and information about the protection of the participants’ anonymity. All participants in this project were made aware of the nature and purpose of the project as well as the procedures during the initial contact and through a release form (see Appendix C) that was signed by each of the participants before proceeding. The release form provided an overview of the project, reminded the participant that they may opt out of this project at any time for any reason, included them in the meaning making following each of their interviews and in connecting all of the participants, and ensured their anonymity during and following this project. All of the participants in this study are over the age of 18 and were interviewed using a semi-structured protocol adapted from an interview protocol described in Stewart (2008). This protocol follows a three-interview format described in the “Interviews” section of this proposal and in more detail in the Appendix A.
CHAPTER 4. ANALYSIS AND RESULTS

“It is impossible to identify people in terms of structure…identity is based instead on culture which acquires new functions in industrial society. People…must be equipped with the skills to move between roles” (Gellner 2006).

Each participant’s oral narrative was related over three one-hour periods in which they were interviewed in a semi-structured format. A timeline of the interviews, edits, merging, and coding is provided in Appendix F. The focus of the first interview was life context and life history. Each second interview built on the biographical background from the previous interview and focused primarily on cultural and scientific areas of expertise. The third interview directed the participants to reflect on themes/meanings both individually and collectively.

A semi-structured protocol (see Appendix A) was used as a guide to maintain consistency throughout the data gathering process. However, each subsequent interview (and the questions used) with each participant was based on the information they provided during their previous interviews. Specific aspects of each interview were different while the overall framework, guided by the protocol, remained the same. Each interview was transcribed and shared with the participants so they could edit them to accurately reflect their thoughts, opinions, and meanings. The three interviews were merged to create one coherent narrative for each of the ten participants based on the interview topics. I shared each merged narrative with the individual participant so they could revise their account and/or elaborate upon any topic within the narrative.

Participants in this study were all of Native Hawaiian ancestry and currently involved in the scientific community as either undergraduate or graduate students in STEM-related fields of study, science teachers/professors, or professionals in science fields. While I made a conscious effort to gain the broadest representation of participants for this project,
factors including time to schedule and conduct interviews, the geographic location of the participants, and the financial resources required to meet face-to-face with participants constrained the research.

All participants were above the age of eighteen years old and living in the state of Hawai‘i. Just as the terms “American” and “European” are used to refer to broad groups of people of various social, economic, and racial backgrounds, so too does the term “Hawaiian.” In an effort to break through stereotypes and enhance our understand of what it means to be a member of the Hawaiian community, this study captures and gives voice to members of this community from a range of social and economic backgrounds. Every effort was made to interview individuals who vary in experience, age, and socio-economic background (See Appendix E for the basic biographical information about each participant).

In this chapter, it is my aim to give a sense of the life experiences of ten Native Hawaiian members of Hawai‘i’s STEM community. This analysis explores the lives of ten individuals of Native Hawaiian ancestry who have chosen to make a life for themselves in various STEM-related fields. The themes gleaned from their experiences give a deeper understanding of the experiences being Native Hawaiian members of the STEM community and the challenges and opportunities that come from merging, separating, and navigating the sometimes treacherous waters of personal and professional identities. Their respective stories represent their inspirations, influences, challenges, and experiences. Initial coding of each narrative revealed four major themes: identity salience, personal/cultural connections to science, a Hawaiian doing things vs. doing Hawaiian things, and being a first generation Native Hawaiian scientist.
Identity Salience

The concept of identity salience—one “role” being more or most prominent or conspicuous at a given time—was the central theme in the development of this project and is, therefore, a major theme that emerged through open coding of participant interviews. Axial coding revealed connections between participants as personal/professional identity salience shifted, overlapped, merged, and conflicted. The acceptance of two (or more) identities mirrors the paradigm shift described by Sen (2006) and Appiah (2006) and reconceptualized models by Abes and Jones (2004), Abes, Jones, and McEwen (2007), Brewer, Jones (2000, 2009), Kiang, Yip, and Fuligni (2008), Moran (2003), Orbe (2004), Reed (2001), Stewart (2009, 2008), and Weber (1998) away from singular identity models of individuals and groups. Additionally, the participant data revealed a mixture of both internal cognitive processes described in identity theory (Hoelter 1983; Nuttbrock and Freudiger 1991; Lobel 1992; Stets and Burke 2000; Stryker and Serpe 1994; Stryker 2000) as well as motivational influences exerted through external social situations, including in-group/out-group membership, as described by social identity theory (Cornelissen 2007; Ethier 1994; Hargie 2008; Haslam et. al. 1999; Hogg et. al. 2004; Tajfel 1974; Terry 1999; Whetten 2002).

Initial and axial themes gleaned from participant interviews support the assertion of both theories “that the self,” as described by Stryker (1968), is “complex and differentiated.” However, the participants’ conceptualization of their own identities, especially when multiple identities are considered, revealed a level of complexity beyond the semi-rigid hierarchy espoused by the aforementioned theories. Rather than describing their identities hierarchically, many of the participants stressed that cultural, social, personal, and professional identities were equal in different ways. As parents Hoku,
Aloha, Pōmaikaʻi, and Melemele all noted that it was impossible for them to judge a “parental” identity as more important, and therefore more salient, than a Hawaiian cultural identity or professional scientist identity. While the level of salience might change, despite what Identity and Social Identity theorists have suggested, the importance of any given dimension of the participants’ identity does not.

Instead of a hierarchy, the participants understanding of the interaction and negotiation of their personal, cultural, and professional identities suggests processes that are extremely fluid and dynamic with saliences occurring singularly and/or simultaneously. The level of salience for one aspect of their overall identity or the level of interaction of multiple saliences is predicated upon internal cognitive processes generated through childhood experiences and influences and reinforced socially, culturally, and psychologically throughout the narrators’ lives.

Although all of the participants stressed the importance of recognizing, accepting, and celebrating the different facets of their identity, many of them stressed that being Hawaiian was an aspect of their identity that is almost constantly salient. Kaipo, a graduate student, was the only participant to describe himself as a scientist first. The salience of this particular identity for all participants will be discussed later in this chapter. The primacy of the Hawaiian identity and the “self-evaluation of (a culturally based) role-identity” (Callero 1985, 37) was echoed by many participants, particularly the younger narrators like Lawaiʻa, Keala, and Kahelelani. Lawaiʻa explained that while he has tried to figure out who he is as both a Hawaiian and a researcher “I’m always Hawaiian first. I think, and I act, and I speak like a Hawaiian. That’s my backbone.”
Hawaiian Identity Salience

Cultural identity salience was a central theme amongst the participants according to the data in this project. As noted by Sellers et al. (1998) cultural identity is one of the most heavily researched areas of identity theory and identity salience. Cultural identity has been associated with a number of phenomena including self-esteem, academic performance, preference for same-race counselors, preference for same-race sexual partners, and career aspirations. An individual’s cultural identity “imbues the world with meaning, order, stability, and permanence” (Solomon, Greenberg, and Pyszczynski 1991, 96) and gives individuals the “feeling that one is a part of something larger and significant” (Walsh and Smith 2007, 103). Initial coding revealed individuals’ “Hawaiian” identity as salient for almost all of the narrators with several describing it as a core or anchor identity they use to inform other personal and professional identities, situations, and decisions. For many of the participants, their sense of being Hawaiian originated early in their lives through family events and interactions. Their cultural identity was maintained in a variety of ways even if, as several narrators noted, the participants and their families did not participate in “Hawaiian things.”

Weaver (2001) explains, “there is little agreement on precisely what constitutes indigenous identity, how to measure it, and who truly has it” (240). Coding revealed that individuals’ Hawaiian cultural identity salience manifests itself in several ways including language, music, food, and activities. Being Hawaiian, to many of the participants, involves some knowledge or connection to Hawaiian language. The challenge, of course, is that for an extended period of time there was widespread discrimination against Hawaiians and Hawaiian language. As a result, there are many members of the Hawaiian community who can no longer speak Hawaiian fluently. To remedy this, more than half
of the participants are currently engaged in the process of learning and reclaiming the Hawaiian language. Keala, Aloha, Kahelelani, and Hīhīmanu spoke of the need to do this not only for themselves but also for future generations. In this same vein, many of the participants actively study and perform Hawaiian music both formally and informally. Melemele, Lawai‘a, and Keli‘i find the music both soothing and invigorating and has enabled them to find deeper meanings to chants, prayers, and songs.

One facet of Hawaiianess that was mentioned by many of the participants was the role that food has played in forming and maintaining cultural connections. Some were taught at an early age how to catch their own food, which gave them a deep love and taught them to appreciate the ocean. Others, because of their multiethnic families, mixed traditional Hawaiian foods with food from other cultures. Some, such as Hīhīmanu, claim a Hawaiian identity but rarely eat traditional Hawaiian foods. As she explained during one of her interviews, “we didn’t usually do anything ‘Hawaiian’ like I hardly eat Hawaiian food. Even my mom cooks the Keoki’s lau lau!” Hula (including chanting), paddling, luaus, playing ukulele and guitar, engaging in outdoor activities (particularly fishing) were common “Hawaiian” activities participants’ families engaged during their formative years and gave them a sense of cultural connection.

Although the language, food, music, and activities could be seen as qualifiers for who is Hawaiian and who is not, several participants were quick to point out that these concrete examples are not the end-all and be-all of being Hawaiian or even of being a certain kind of Hawaiian. Coding during cross-case analysis revealed the importance of deeply held Hawaiian values such as family, community, responsibility and aloha as one of the most important ways cultural identity salience manifests itself. As Lawai‘a noted
during his interviews, “You should know the (Hawaiian) culture. But that’s not saying that to know the culture is to live the culture. You can have non-Hawaiians be fully involved and live the lifestyle of being Hawaiian and understand the culture.” At the same time, as many participants noted, we also have Hawaiians who know nothing of their own culture and who don’t live the culture.

This important distinction, between social identity and social group membership, mirrors thoughts on social identity theory by Brewer (1991).

“Social identity should not be equated with membership in a group or social category. Membership may be voluntary or imposed, but social identities are chosen. Individuals may recognize that they belong to any number of social groups without adopting those classifications as social identities. Social identities are selected from the various bases for self-categorization available to an individual at a particular time. And specific social identities may be activated at some times and not at others” (477).

Kaipo illustrates this distinction. He acknowledged his membership in the Hawaiian social group and his Hawaiian roots, especially as a graduate of Kamehameha Schools. However he has chosen not to adopt a Hawaiian identity. He contends that he “never understood why Hawaiian or being Hawaiian puts you on a pedestal.” Adding that he does not see being Hawaiian as anything different, greater, or lesser than any other nationality or ethnicity and “honestly can’t answer ‘what does it mean to be Hawaiian?’ because (he) can’t even make that connection.” According to Stets and Burke (2000), “the core of an identity is the categorization of the self as an occupant of a role, and the incorporation, into the self, of the meanings expectations associated with that role” (225). Although Kaipo may disagree about the importance of Hawaiian identity salience, data showed that there are meanings that resonate collectively across the participants as well as unique meanings based on individual experiences. Several of the participants stressed that these core cultural themes not only link them to the present-day Hawaiian
community, they provide a link to their ancestors and gives them a sense of responsibility to future generations of Hawaiians.

Although the Hawaiian aspect of the participants’ identities could be considered one of the most salient, it is far from the participants’ only dimension of identity. All of the narrators in this project were selected because they are members of Hawai‘i’s science, technology, engineering, and math (STEM) community. As such, they not only self-identify with the cultural identity of being Hawaiian, they self-identify with the professional/educational identity of being a scientist. The participants’ embrace of science, its methods, and methodology points to a personal/cultural connection that each has made in their pursuit of a beautiful life in science. This theme will be explored later in this chapter.

**Professional Identity Salience**

The idea of identity salience also includes the participants’ identities as scientists— a professional identity that all of the participants have chosen to embrace. The importance of science, technology, engineering, and math (STEM) have become more prominent in educational and economic discussion nationally and internationally has been mirrored by a growing body of research involving professional identity salience for those individuals involved in the sciences. In the spirit of postmodern/multicultural/decolonized views of STEM, researchers such as Brown (2004), Chinn (2002, 2006), Hurtado (2008), and Zuniga (2005) have focused their studies on minority, disenfranchised, and traditionally underrepresented groups in the sciences.

As Native Hawaiian members of Hawai‘i’s STEM community the narrators experience of navigating and negotiating the saliences of two dimensions of their identity that could, at times, contradict each other can be valuable and enlightening. While
studies of identity, social identity, and intersectionality advance theories regarding the source of identity salience, participant data gives us a more concrete view based on their individual and collective experiences.

Where Does Their Salience Come From?

What makes being Hawaiian and being a scientist such salient dimensions of the participant’s overall identity? For most of the participants being Hawaiian is assumed. It is just who they are, and it is as inseparable as their skin color and gender. Kahelelani explained that, for her, Hawaiian is “the only culture I really know. I am Hawaiian so it’s like, it’s not like I have to put effort in to being Hawaiian. I’m not trying to be Hawaiian. It’s who I am…it’s all I know.” Kahelelani elaborated on this further explaining that she has to work at being a scientist whereas she does not have to work at being Hawaiian. Kaipo, on the other hand, felt the same way about being a scientist. “I guess the most fitting (identity) would be that I am a scientist and a textbook nerd.” As he revealed, he has never felt a firm cultural connection to being Hawaiian despite having attended Kamehameha Schools and receiving scholarships because he is Hawaiian.

With regard to their core identities, many of the participants see things through both a Hawaiian lens and a scientist lens. Though these lenses do occasionally conflict with one another, the participants have been able to navigate and negotiate them. Cross case analysis of participant data revealed that the Hawaiian lens enables the participants to use the values that were instilled in them at a young age to guide their decisions personally, culturally, and professionally. The scientist lens has not only given all of the participants a degree and career track that they enjoy, it also gives them a method of analyzing the world around them and tools to better their community. Although many of the participants admit that there have been challenges in accepting both of these identities,
they also disclosed that the sources of salience for both the Hawaiian and scientist
dimensions of their identity can be traced to three main sub-themes: salience emerging
through connections made through family support, place-based opportunities to reinforce
salience, and situational salience.

**Family Connections and Support**

Family support and encouragement, according to the participants, made the biggest
impact in the development and maintenance of both Hawaiian and scientist identity
salience. Analysis of the participant data showed that positive cultural interactions with
family members resulted in higher rates of salience for the Hawaiian aspect of the
participants’ identities. Along these lines, positive professional interactions also resulted
in higher rates of salience for the scientist dimension of some of the participants’
identities. Lawai‘a, for example, spoke frequently of his family’s trips to the beach. On
these trips he learned about the ocean, tides, and the Hawaiian names of fish and plants
from his parents and grandparents. These experiences not only generated and reinforced
the salience of the Hawaiian aspect of his identity but also, in part, led to the eventual
emergence of his scientist identity when he was able to connect cultural and scientific
knowledges. Kaipo’s parents supported his love for science by allowing him to enroll in
summer science courses and encouraged him to pursue a college degree and become a
doctor.

There are, however, some exceptions. The Hawaiian dimension of Kaipo’s identity,
for example, is not particularly salient despite his family’s participation in Hawaiian civic
clubs as well as a family history of attendance, including his own, at Kamehameha
Schools. Additionally, Melemele’s mother almost completely turned away her Hawaiian
identity after remarrying. She chose instead to raise her family within the Puerto Rican culture. For Melemele, Hawaiian identity salience emerged after the birth of her children. Aloha spoke of his parents refusing to allow him to take advanced science and math classes in high school and not helping or hindering his desire to go to college and become an engineer. Keala, who grew up on the Leeward side of Oahu, had no professional role models to look up to, and he saw college and science, a subject he was already interested in, as a way out of his neighborhood.

Incident analysis of the data showed the source of the participants’ Hawaiian identity salience was primarily maternal. Both male and female participants, of all age groups, spoke of their mothers and grandmothers as sources of Hawaiian values. All of the participants consider family to be a core Hawaiian value. While this project lacked a full gender analysis, both the male and female participants see Hawaiian women as having a major role and responsibility in perpetuating Hawaiian culture by bearing children and providing them with a certain level of cultural education. This type of self-categorization or identification (Burke 1980, Callero 1985, Cameron 1998, Eliason 1996, Haslam et al. 1999, Hogg and Terry 2000, Hogg, Terry, and White 1995, Palomares 2004, Stets and Burke 2000, Stryker and Statham 1985, Stryker and Burke 2000, Stryker 1968) shows an internal gender-based decision making process occurring within the larger Native Hawaiian social structure that influences their behavior.

Data gathered through participant interviews did not make clear whether this process occurs at the conscious or subconscious level, however all of the female participants emphasized strong maternal cultural role models during their most formative years. This is particularly interesting given that Pōmaikaʻi is the only mother whose own mother is
both Hawaiian and actively embraced her Hawaiian identity. Melemele’s mother is Hawaiian but is only now embracing her Hawaiian identity so she did not provide that maternal cultural role earlier in Melemele’s upbringing. Additionally, both Hoku’s and Kahelelani’s mothers are Caucasian and from the Continental U.S. therefore the Hawaiian values they were instilled with came from their fathers and the paternal sides of their families.

Many of the male participants including Keli‘i, Keala, Lawai‘a, and Aloha also cited a strong maternal influence on their commitment to and enduring salience of their Hawaiian identity. Conversely, axial coding revealed that paternal support for Hīhīmanu, Pōmaika‘i, Kaipo, and Aloha focused less on cultural influence but rather support-in-general. Focused coding for words and phrases revealed common adjectives such as “strong/strength,” “quiet,” “reserved,” “hard working,” and “being there” used to describe the fathers of many of the participants. A stark contrast to words and phrases used to describe mothers and other maternal influences including “warm,” “friendly,” “sensitive,” “loving,” and “kind” emerged through this level of coding. Exceptions include Melemele’s description of physical and emotional abuse from her mother, which led her to use drugs, drop out of school, and run away from home. Keala described a physically, emotionally, and psychologically harsh childhood in which he was more of a parent to his siblings than his parents in addition to feelings of loneliness and shame because of his knowledge that he was gay. Aloha felt that his mother resented the warm and friendly relationship he had with his father and Keli‘i, who barely mentioned his father at all, spoke more fondly of his grandmother when he was a young child and later
experiences in a Hawaiian fraternity in college as sources and supports of his Hawaiian identity.

Smith (2004) remarks that one of two frameworks that shape and develop indigenous culture is imperialism. She explains imperialism and colonialism are “part of our story, our version of modernity” (19). Just about all of the participants acknowledged and spoke about the fact that there was a time, not so long ago, when being Hawaiian was considered a bad thing. So while they feel enormous pride in being Hawaiian, their hearts ache for those who do not have that pride and for those who still have anger rather than trying to find a path forward. Participant data suggests that while participants’ Hawaiian women/mothers may have attained a certain level of self-identification and satisfaction in their roles within the larger Hawaiian community, the fathers have not (Cook et al. 2005). “Colonial domination including global touristic commodification” have had a negative impact on the ways indigenous men create meaningful identities and social practices and “as a consequence, many indigenous Hawaiian men feel themselves to be disconnected, disempowered, and sometime emasculated” (Tengan 2008, 47).

All of the participants are the first in their family to show interest in science as a career and attend college, let alone pursue an advanced degree. This theme will be explored in more detail later. It is worth noting that almost all of the participants felt supported in their pursuit of education. Kahelelani, for example, cried while speaking of the happiness and pride her father expressed to her when she was accepted into a graduate program at the University of Hawai‘i. Keala, on the other hand, is the only participant to experience any type of criticism from his immediate family. He said that they found no value in his field of study and instead urged him to go in to something
more labor related instead of going into science. He attributes their view to ignorance and lack of understanding on their part because he is the first in the family to attend college. Additionally, Keala acknowledged that it may also be that his parents and family members do not want to “lose” him to a more educated community. Keala aims to look beyond some of the anger and frustration currently expressed by some members of his family. Keala sees helping himself and his family in getting out of the social, psychological, and financial situation they finds themselves in at this time as a major motivation to become educated.

**Place-Based Opportunities for Salience**

Family and community have an effect on the salience of the scientist and Hawaiian dimensions of the participants’ identities. Further cross case incident analysis of the data revealed geography as a second source of salience for the participants, particularly in terms of their Hawaiian identity. In addition to the colonization and decolonization processes, Denzin, Lincoln, and Smith (2008), Laenui (2000), Smith (2004), Wilson (2008), and Wilson and Bird (2005) cite ecology–relationship to the land–as a framework that continues to shape indigenous culture. Analysis of the data in terms of geographic influences on Hawaiian identity salience mirrors the emphasis stressed by the aforementioned researchers. Almost all of the participants admitted that living in Hawai‘i makes their Hawaiian identity more salient.

Geographic access to the food and language, as mentioned earlier, the people and sites considered important to the Hawaiian culture (lo‘i, fishponds, and heiaus) makes salient the participants’ Hawaiian identity on a regular, if not daily, basis. Cultural reminders also include, as Kahelelani pointed out, natural aspects of the land (mountains,
ocean, plants, and animals) that have become culturally symbolic in addition to 
aforementioned manmade features. She explained how “you can walk around Hawai‘i 
and actually see Hawaiian culture facing you in so many different elements here in the 
islands—the plants, the birds, all those things I would not have had growing up somewhere 
else.” Additionally, participants such as Hīhīmanu, Pōmaika‘i, and Melemele shared that 
if they were living on the “mainland” they probably would not know their Hawaiian 
culture or Hawaiian language or how to be Hawaiian. In this way, according to the 
participants, Hawaiian identity salience is very place-based.

This ecological salience was most evident, according to the participants, when they 
each came in contact with Hawaiians who were either born and raised in the Continental 
U.S. or had moved to the Continental U.S. early in their lives. According to Aloha, 
Hīhīmanu, and Lawai‘a, all of whom have Hawaiian relatives living on the Continental 
U.S., these individuals had little to no knowledge of their Hawaiian culture and the values 
important to Hawaiians living in Hawai‘i. Khaulani (2007) also laments the 
“deracination” of Hawaiians who lack access to their culture due to geography. 
However, Aloha, Hīhīmanu, and Lawai‘a noted that when these relatives came to visit 
Hawai‘i there was an active search and embrace of culture for which they were 
unprepared. Having worked with Hawaiian students from both Hawai‘i and the 
Continental U.S., Hoku echoes these comments by sharing how “we had one Hawaiian 
student from the mainland and the attitude was that she was definitely searching for more 
of her culture when she came here. She wanted to get in touch through language and 
nature and dance.” In Hoku’s mind, there was no doubt that there was a cultural 
yearning.
On the other hand, Kaipo felt that his childhood experiences could have occurred anywhere and, with some exceptions, did not generally have to have happened in Hawai‘i. As he stated during his interviews, “While I’m native here and Hawaiian…I don’t think there’s anything specific about my childhood that needed to happen in Hawai‘i. There’s nothing particular about my childhood that couldn’t have happened anywhere else. The things I experienced growing up could have happened anywhere.” Additionally, Kaipo expressed the opinion that while Hawai‘i is a unique place there is a naivety about the larger, broader world beyond Hawai‘i’s shores. “There’s so much more out there,” he explained, “than what’s on this small patch of land in the middle of the ocean. It sometime seems like the only people that really care about Hawai‘i are the people in Hawai‘i.”

The geographic impact of being in Hawai‘i extends beyond the salience of Hawaiian identity and also affects the salience of the participants’ scientist identity. Lawai‘a noted that being in Hawai‘i impacts the narrators’ choice of research projects and careers. As a graduate student seeking to connect local, cultural, and scientific knowledges as part of his graduate studies, Lawai‘a readily admitted that it would have been harder to reconcile the scientist and Hawaiian identities had he done his research project in the Continental U.S. He explained during his interview, “their understanding of (Hawaiian) culture, its importance, and how it IS science may not be readily accessible and acceptable.” Had he attended a “mainland” university he does not think he would have “the same room I have here (in Hawai‘i) to do everything in a cultural manner.”

Several participants chose to pursue degrees in Hawai‘i but others—Aloha, Kaipo, and Hoku—were the only ones to pursue and receive degrees from universities outside of
Hawai‘i. Once they graduated, however, they returned to Hawai‘i. Aloha returned to begin his engineering career. Kaipo and Hoku returned to attend graduate school and medical school respectively. The other participants chose to attend university in Hawai‘i to remain close to family and, as many admitted, it was cheaper than going away to school. For those participants who have gone on to pursue graduate degrees the choice to stay in Hawai‘i has been a strategic one. Lawai‘a’s research, for example, blends traditional Hawaiian and modern scientific knowledges, something that may not have been possible at a university outside of Hawai‘i. Hawai‘i’s world-class astronomy facilities on Maui and Hawai‘i Island have been advantageous to Kahelelani and led her to choose to stay in Hawai‘i even when urged by her peers and advisors to attend another schools because “it looks better on your CV.”

Being Hawaiian in Hawai‘i, a dimension of identity shared by all of the participants, has had the consequence of determining, in some cases, what branch of science they wish to explore. More importantly, according to several of the narrators, the ecological/geographic salience of their Hawaiian identity has guided many participants in how they do science, where they do science, and the kind scientists they have become. These connections will be explored further in the “Personal/Cultural Connections with Science” section of this chapter.

In our discussion on the impact of being Hawaiian in Hawai‘i, as opposed to being Hawaiian somewhere else, several of the participants expressed how they felt about the Hawaiian renaissance and cultural revitalization that has taken place since the 1960s and 1970s. Some of the narrators, like Keli‘i, Melemele, and Aloha were around and were at the forefront of those activities. Keli‘i, for example, was in college at the time and
became active in the music and political aspects of the renaissance. Other participants are too young to recall the early years of the Hawaiian renaissance but expressed gratitude for those who fought so they could be more culturally aware. Additionally, many of the younger participants are active in groups that allow them to express their Hawaiian-ness and to make their culture identities salient in a variety of personal, professional, and cultural situations.

**Situational Salience**

Participant data echoed the themes expressed by indigenous researchers that both family and a sense of place influence the salience of their Hawaiian identity. However, the narrators also acknowledged that cultural identity salience and the management of this salience is also situational. Aligning participants’ experiences with both Identity and Social Identity theories identity construction and salience is managed and influenced by both internal and external factors. While their Hawaiian identity is a core identity that both anchors and guides them on a day-to-day basis, the degree of Hawaiian-ness they might openly display, according to cross-case analysis, depends greatly on who the participants are speaking with, where the situation occurs, and the circumstances of the encounter.

Lawai‘a, Hoku, Aloha, and Hīhīmanu shared instances where they had to be “either a little more or a little less Hawaiian” based on where they were, who they were with, and the expectation of the people around them. Lawai‘a, for example, admitted that when attending scientific conferences the “Western scientist (identity) doesn’t become the primary identity but it kind of evens out with the Hawaiian identity.” Hoku, who practices medicine in a predominantly poor and Hawaiian community, has found herself
“going right in to the pidgin with certain situations to be able to get a message across to patients” so she comes across as “one of them.” Situational salience of this type requires the participants to become “cultural chameleons,” a phrase that came up several times during cross-case analysis. Hīhīmanu echoed these comments during her interviews as well:

“It’s about the people that are around you that make you who you are in that situation. I definitely think the expectation of people around me affects my identity. When I’m with a bunch of Hawaiians I get moke (laughs). I also find that when I’m in the middle of a conversation with my friends in pure English and just hanging out having a good time and one of my friends walks in the room I’ll say, “eh cuz, waz up!” I’m just a completely changed person. If I’m with a group of engineers I’m automatically very nerdy.”

Analysis also revealed that in situations where the participants were one of a few Hawaiians, or the only Hawaiian, there was some divergence in attitudes. Some of the participants, like Hīhīmanu, Keliʻi, and Kahelelani, purposely did things to call attention to their own Hawaiian identity and/or advocate for the Hawaiian culture in general. For example, when Keliʻi travels he takes his briefcase, his suits, and coats as well as his ukulele. “I take something from Hawaiʻi,” he said, “and people react differently to me as a result.” As a graduate student, Kahelelani has been able to sit in on astronomy-related interviews and receptions. As one of the few Hawaiians in her department she has put it upon herself to make new faculty and visitors aware of the significance of astronomy in Hawaiian culture as well as the importance of places like Haleakala on Maui and Mauna Kea on Hawaiʻi Island.

Other participants revealed that while they make their Hawaiian-ness known within their professional circles, they are hesitant to openly share cultural practices and information. Lawaiʻa sees it as an issue of trust – he has worked hard to earn the trust of the individuals he works with in his research project, and he is hesitant to share some of that information without following social and cultural protocols. Keala reiterated this
point during his interviews by explaining how he chants to the forest before entering, but he does this silently rather than aloud because he does not wish to share this aspect of himself with others.

**Being Multiethnic**

One of the major focuses of this project was on the salience of the participants’ Hawaiian identity. However, during the course of this investigation all of the participants revealed that they are multicultural. This facilitated discussion of a multicultural dimension of their identity in their families and upbringing. Several participants spoke about the advantages and disadvantages of being a multiethnic person in a multiethnic society. The overall advantage, according to the narrators, is the variety of perspectives being multiethnic affords them and the connections they are, therefore, able to make with members of other ethnicities. Hīhīmanu and Kaipo both commented on how they have a “cosmopolitan look” as a result of their mixed ethnicities that allows them to pass for just about any ethnicity and, as a result, make connections with others. Kahelelani echoed these thoughts while adding that being multiethnic “leads you to be open to other cultures and other ethnicities and it’s that sense of aloha where you just welcome everybody.” Keliʻi, Hoku, and Aloha all noted that it is “really cool” being multiethnic because you get to celebrate the positives and generally get the best of all those cultures and ethnicities – whatever those bests are or what you interpret them to be.

The biggest disadvantage, according to the participants, of being multiethnic came from the physical effects of multiple ethnicities, particularly skin color, as well as some cultural confusion. Kahelelani, Aloha, Hīhīmanu, and Hoku, all light-skinned Hawaiians, expressed some of the challenges they faced personally, culturally, and educationally because of their skin color. As Kamehameha Schools graduates, Aloha, Hīhīmanu, and
Hoku faced certain social challenges because they did not look the way many assumed Hawaiians at Kamehameha Schools should look. During his interview, Aloha spoke briefly about how he was teased for being light-skinned and was asked, “Where’s your Hawaiian?” to which he would answer, “It’s in my baby toe.” Hoku spoke of times she felt “weird.” She explains, “all my friends knew that I had a white mom but nobody else’s mommy was that white.” Even Kahelelani, who attended public school, has faced challenges and has felt “like I have to fight for my credibility as a Hawaiian” because of the color of her skin. Pōmaika‘i countered these ethnically related challenges when she said, “part of being Hawaiian is being proud of who you are and recognizing the different parts that make up (who you are).”

**Participants Visualizing Their Identities**

The participants in this project readily acknowledged that both the Hawaiian and scientist identities are two of the many dimensions of identity they possess. Line-by-line analysis of the participant interviews showed awareness of how complex various dimensions of identity can be. For example, the Hawaiian aspect of identity is central for many of the narrators but it is also part of broader identities including “local” and “American.” When asked to self-identify during the interview process several participants, including Pōmaika‘i, had a long list of different dimensions of their identity they feel contribute to their overall identity. When asked, “Who is Pōmaika‘i?” she responded, “I am a human being, woman, daughter, sister, mother, companion, auntie, friend, god mother, Hawaiian, Chinese, Caucasian, educator, scientist, joyful, hopeful, compassionate, blessed, confident, respectful, teachable, and driven.” She also admitted there are many more facets to who she is, which change based on time and experience.
Pōmaika‘i and other participant’s notions of their own identity are more akin to the multidimensional identity models (Reynolds and Pope 1991, Jones and McEwen 2000, Abes and Jones 2004, Abes, Jones, and McEwen 2007, Jones 2009), which acknowledge multiple intersecting and interconnecting dimensions of identity. These models, just as the participants they represent, are fluid and dynamic “representing the ongoing construction (and interaction) of identities and the influence of changing contexts” (Jones and McEwen 2000, 408).

Rather than attempt to create a static model of the multiple dimensions of their identity, the participants were asked to visualize their assorted identities and provide some analysis of the image. Incident-by-incident analysis revealed responses that were as varied as the individuals themselves. Images included a table (Lawai‘a), a lone archer (Keala), a tree (Melemele), a mountain (Keli‘i and Hoku), and an octopus (Hīhīmanu). For Lawai‘a a table came to mind because “the pa’koko was really important to the family life. When you start off you’re just a blank piece of wood. Then you get worked on a bit. You get smoothed out; the family provides the foundation, which are the legs and your table can only withstand whatever you put on it depending…on the foundation.” Hoku pictured “mountains with its peaks and valleys and waterfalls flowing from the top down to the ocean. On those mountains are beautiful colors from different flowers.” Hīhīmanu imagined an octopus “with many legs. For the he’e, the legs can work separately most of the time but sometimes they all work together going in the same direction. That’s when great things happen!”

Despite the visual differences, most of the participant’s images revealed a keen understanding of the multiple dimensions of their identities and how those dimensions
support, interact, and intersect with each other. Hoku’s flowers can be seen and admired individually but can also be combined to form a beautiful multicolored tapestry. Lawai’a’s table is worked on, shaped, and smoothed by life changes and events and Hīhīmanu’s he‘e can use its legs individually or to combine two or more legs depending on the situation. Their dimensions of identity are variously experienced, in some cases, individually but with the intersections demonstrating that no one dimension may be completely understood singularly. Instead, single identities can be understood better in relation to other dimensions.

**Personal/Cultural Connection To Science**

The second major theme that emerged during cross-case analysis of the participant data was the personal connection that participants made to the STEM-field they chose as their career. Just as the participants of this study pointed to key motivations and supports for the Hawaiian and scientist dimensions of their identities, the narrators expressed, both individually and collectively, key moments that both cemented the scientist aspect of their identity and led them eventually to make science a career. Kahelelani, Aloha, Hīhīmanu, and Kaipo recognized an immediate interest and aptitude for science. Hoku and Pōmaika‘i had life-changing and life-shaping experiences that led them to their chosen fields. Melemele, Keli‘i, Lawai’a, and Keala’s “accidentally” connected with and realized that what interested them already could be called “science.” Nonetheless, all of the participants have personal motives in pursuing a career in science. Through the interview process, all of the participants revealed a genuine interest and personal stake in their chosen fields. The fact they have, therefore, dedicated their lives to science should not be surprising. Yet it is surprising to subscribers of a positivist worldview of the nature of science.
Why This Theme Matters

Until recently, science education materials and programs designed specifically for use with indigenous peoples were geared towards assimilation and acceptance of so-called western scientific methods over native cultural beliefs (Aikenhead 2001a, Forbes 2000, Kana‘iaupuni 2005, Kawagley 1999). Modernity’s goal has been to utilize science and technology to obtain and understand the universe as objectively as possible. This is accomplished by finding more and more ways to remove ourselves from the objects (or subjects) that are studied. This has driven, in large part, scientific advances in technology to measure things more accurately and reliably even at the nano-, pico-, and femto- levels to better understand the reality in which we all live. Technology has given us the ability to peer into the farthest reaches of space, explore the inner workings of our DNA, and explain physical, chemical, and biological phenomena.

The late-19th and 20th centuries have come to be known as the age of modernity. The positivist worldview is one in which science and technology, including the use of mass communication and transportation, has reshaped the way we perceive each other, the world, the universe, and ourselves. Within the positivist perspective, as espoused by both Ayer and Monod, science is the sole claimant to knowledge and truth. Scientific knowledge is objective and can be verified. Although an exact definition is difficult to pin down, the overall “exaggerated trust in the efficacy of the methods of natural science” or the belief that “science explains everything important” (Frank 2013) has come to be known as scientism. All other ways of knowing are infused with subjectivity and cannot be verified objectively. Therefore cultural and religious knowledge, literature, and morality have no basis for truth. According to this perspective, science distinguishes itself from narrative knowledge and place-based tribal wisdom communicated through
myths, legends, and experience by emphasizing information as a means rather than an end.

Ayer (1952) expresses this perspective emphasizing, “the criterion which we use to test the genuineness of apparent statements of fact is the criterion of verifiability” (35). This criterion, according to Ayer can vary, but he makes clear that knowledge is valid if and only if it does “not include any statement that is not either analytic, or directly verifiable, or capable of being independently established as indirectly verifiable” (38). Scholars such as Aikenhead (2002b), Barnhardt and Kawagley (2005), Boyne (2003), and Kawagley and Barnhardt (1998) advocating for the inclusion of Indigenous ways of knowing in science curriculum often equate the positivistic point of view with scientism. While similar, it is important to distinguish between the two.

Positivism is an epistemological and philosophical framework based on the view that information derived from logical and mathematical treatment of sense data is the source of authoritative knowledge. Scientism, a term often used pejoratively, places value on the universal applicability of the scientific method and approach. In a recent article in The New Republic Steven Pinker attempts to alleviate fears of scientism by claiming “scientism” is more of a “boo-word than a label for any coherent doctrine” (Pinker 2013, 29). In his article, Pinker makes the case that while science has reshaped human civilization and has become indispensable, it is not particularly “wise or noble. On the contrary, the defining practices of science, including open debate, peer review, and double-blind methods, are explicitly designed to circumvent the errors and sins to which scientists, being human are vulnerable” (ibid).
The scientistic worldview dismisses non-scientific views by declaring them not merely wrong or false, but meaningless. Monod (1971), echoing Ayer’s sentiments, explains “the moment one makes objectivity conditio sine qua non of true knowledge, a radical distinction, indispensable to the very search for truth, is established. Knowledge in itself is exclusive of all value judgment” whereas anything non-objective, “is forever barred from the sphere of knowledge” (174). This view of the nature of science, as a value-free method of differentiating between knowledge and non-knowledge, forms the foundation of a conception of science embraced by all of the participants in this project.

Ayer recognizes “that scientific laws are often discovered through a process of intuition, this does not mean that they can be intuitively validated” (137). Ayer, Monod, Comte, Mach and others who subscribe to the scientistic view of knowledge find it “essential to distinguish the psychological question, How do our knowledge originate? From the logical question, How is it certified as knowledge?” (ibid).

So-called Western science and scientism’s assertion that these questions and the natures of science they represent are heavily critiqued by Appadurai (1996), Bhaskar (2008), Cajete (1994, 2000), Feyerabend (2010, 2011), and Harding (1998). Feyerabend, criticizes Monod, calling his worldview of the nature of science “cold and austere...proposing no explanation but imposing an ascetic renunciation of all other spiritual fare. It (science) does not deal with meanings, it intentionally removes everything that is only vaguely related to them” (6). Both Frank (2013) and Slattery (2013) critique Pinker’s (2013) position that science can offer those who adhere to its principles a sense of meaning and a moral code that will allow humanity to flourish in a way “the humanities” never can. Harding (1998) goes a step farther by challenging “the
cognitive core of modern science that has been identified in many of the postcolonial science studies is the claim to, and valuing of, cultural neutrality” (61).

Noë (2013) notes that many of us are “interested in whether some scientists are biased, or dishonest, or whether the path or research is sometimes influenced unduly by the agencies or industries that fund research.” These are important questions, “but they take for granted that science is value-free in its workings, at least when it is not subject to corrupting influences from without.” Harding’s (1998) critique of modern science’s Eurocentrism argues that, “if it’s value free, then it’s not value free” (61). She and other scholars such as Putnam (1989, 2004) and Sen (2005) cite so-called neutrality as a European-Western value associated with science since the Enlightenment and that most other cultures do not value neutrality. Noë (2013) explains:

“A good scientist, like a good detective, uses his or her own judgment. Not all possibilities are worth considering, not because they are impossible, or because the evidence at hand rules them out, but because, given what we know about how the world works in general, they seem irrelevant and far-fetched. It’s not reasonable to worry about far-fetched possibilities.” Individuals and cultures base their knowledge on their values and they value their own values.

Putnam (2004) argues that science relies on epistemic values. “The classical pragmatists Pierce, James, Dewey, and Mead, all held that value and normativity permeate all of experience. This point of view implies that normative judgments are essential to the practice of science itself” (30). Accordingly, as Native Hawaiian members of the science community, each of the participants in this project would be expected to rely somewhat on their cultural beliefs and judgments just as Jewish, Christian, Japanese, or German scientists would. The difference being that non-Indigenous cultural beliefs, practices, and traditions are rarely criticized, in relation to science and technology, to the degree indigenous cultures have experienced.

Scholarly critiques of the separation of what is commonly called “science” from local values, narratives, and place-based knowledge mirrors viewpoints expressed during interviews and that emerged through axial and line coding of the participant data. Initial and axial themes that emerged from the participant data acknowledge the navigation and negotiation between the Hawaiian and scientist dimensions of the participants’ identities. Each of the individuals in this project expressed a relationship with science that is highly personal, and in some cases cultural, and subjective. The reality of the participants’ personal relationship with science mirrors similar sentiments by a variety of scholars and is referred to as fact/value dichotomy (Putnam 1989, 2004), transcendental realism.
(Bhaskar 2008), the aesthetic (Feyerabend 2010, 2011), the spirit (Cajete 1994, 1999, 2000), and locality (Appadurai 1996).

These views stand in opposition to the objective, impersonal, and acultural view that many have of science and scientists. Instead, the individuals in the project and their values are placed firmly in the center of their chosen fields (Apthorp, D'Amato, and Richardson June 2003, Baskin 2002, Bishop 1999, Gruenewald 2003, Kawagley 1999, Kawagley and Barnhardt 1998). In Feyerabend’s critique of value-free science, and by extension scientists “are free of values…is simply not so. Carlone and Johnson (2007) build on these sentiments in their attempt to model the interaction of racial, ethnic, and gender identities with an individual’s science identity (See Figure 10). These values play an important role in the constitution of scientific facts” (Feyerabend 2011, 94-95) in that the reasons, drives, and rationales to pursue knowledge differ as much as “individuals differ in their (personal, social, and cultural) inclinations, beliefs, (and) convictions” (9).

**Finding a Beautiful Life in Science**

Just as the salience of participants’ Hawaiian identity formed through the life experiences, the salience of a scientist\textsuperscript{65} dimension of identity for each participant developed through similar means. Both positive and negative life experiences have led the individuals in this project both purposefully and accidentally to what Lee (2007) calls “a beautiful life in science.” Incident analysis of the data revealed that interest in science and the development of the scientist aspect of their identities began during childhood. The reasons for the development of their interest in science and the formation of a scientist identity, however, varied within the participant group. Many of the subjects of this study point to key “aha” moments when they realized they were interested in science in general and/or in a particular science-related field of study. Further axial analysis of
the question, “what experience(s) got you interested in science in the first place?” uncovered three sub-themes. These three sub-themes include childhood interest and aptitude for science, life-changing and life-shaping experiences, and “accidental” connections to science, technology, engineering, and math.

Natural Interest and Aptitude

The hierarchical identity/identity salience models promoted by Hitlin (2003b), Hogg and Terry (2000), Stryker (1968), Stryker and Burke (2000) and the intersection/interaction identity salience models proposed by Abes, Jones, and McEwen (2007), Jones (2009), McCall (2005), and Robinson (1999) both suggest that positive reinforcement of particular identities, or roles, increases the likelihood salience and acceptance of a particular identity during an individual’s lifetime. While there is plenty of research-based evidence to show that both real and existential identity threats can also create and enhance identity salience (Solomon, Greenberg, and Pyszczynski 1991, Solomon, Greenberg, and Pyszczynski 2004, Salzman 2004, Landau 2009c), analysis of the individuals’ interviews in this project revealed the prioritization of education in the participants’ households and, more specifically to this project, supportive environments for their natural interest and aptitude for science.

The childhood interest sub-theme emerged during analysis of Lawai‘a, Keli‘i, Hīhīmanu, Kahelelani, Pōmaika‘i, Hoku, Kaipo, and Aloha’s interviews. The aforementioned individuals all spoke of general education as a major priority during their formative years. For Keli‘i, Hīhīmanu, Hoku, Pōmaika‘i, Kaipo, and Aloha this included an economic sacrifice by their families to send them to various private schools for elementary and secondary education. While many of the participants’ parents graduated
from high school, only a few had parents who had any college-level experience. This, according to the participants, made education even more of a priority. Kaipo, Keli‘i, Hoku, and Pōmaika‘i’s families made it known from a very early age that they needed to go to college in order to be successful. Their families actively supported their academic interests and sacrificed time, energy, and money to help them further their education. For other participants, like Aloha, Lawai‘a, and Kahelelani, college was something their families supported but did not push them towards.

In addition to a high level of general educational support, cross-case analysis revealed a high level of support for the participants’ interest in science, technology, engineering, and math. This support was coupled with recognition of early interest and a capacity for science and math with many individuals recalling the “aha” moment when things just clicked for them. Kahelelani, for instance, explained how she “just had a fondness for” science and math and how she “liked it a lot and just had a knack for it. It was fun.” During her interviews she explained how “at one point in math I was doing graphing, equations, and calculating slopes (and) one day it finally clicked and everything was just so clear to me after that. I totally remember that click!” Additionally, Aloha found early interest in engineering through simple class projects but also by helping his father build and repair things around the house and in their neighborhood.

Many of the individuals in this project spoke of an early fondness for science, but not without some frustrations. Kaipo, for instance, was frustrated with science early in his high school career not because of the science itself, but because he did not understand how his teachers wanted the science reported. Once he figured that out “all of the sudden the C’s that I was getting turned in to A’s.” So great was his parent’s support of his
interest in science that they allowed him to enroll in summer science programs. As he explained “they dropped me off at 7:30 in the morning and they would come and pick me up at 4/4:30 in the afternoon. I’d tell them that I wasn’t done yet. They would come by at 9pm, and I still wouldn’t be done. They would say, ‘You’re in high school and you’re in lab until midnight? What are they having you do?’ We’re doing science!”

A theme of parental support for early interest in science resonated for many of the individuals involved in this project. For Kaipo, and other individuals in this project, the major sources of inspiration and support came from both parents and teachers. For example, both Hīhīmanu and Aloha spoke fondly of their father’s encouragement to pursue degrees in engineering. While they may not have always understood what they were studying, Lawai’a and Kahelelani’s families also encouraged them to get as much education as possible. For Hoku, there was never any doubt that she was going to college, and throughout her college education, despite some early financial and academic challenges she experienced, her family was extremely supportive emotionally and psychologically.

On the other hand, both Melemele and Keala did not receive the same level of familial or academic support described by the aforementioned participants. Keala revealed that while his family has not actively discouraged his interest in science, which began at a young age playing on his grandfather’s farm, they have not been supportive at all. He explained that his family always said he was smart because he got good grades and that he was encouraged to go to college “but no one ever showed me where to go and how to go to college.” While many of the other individuals in this project spoke of education being a priority, as Keala puts it, education was very secondary in his family.
Having a passion for native plants, Keala explained that he sometimes has to justify his interest to his family because they do not see value in using or preserving native plants. But, as Keala revealed, these challenges and experiences help to motivate him and while they may not be entirely supportive of what he studied they are happy that he is happy.

**Life-Shaping Experiences**

Both hierarchical and intersectional research models of identity salience stress reinforcement, both positive and negative, as a key to the acceptance of identity roles. Additionally, these models also emphasize, to a degree, the effect that the strength (i.e. its life-shaping/changing impact) of a experience(s) that occur during an individual’s life as a way in which identity salience can be created and reinforced (Arndt et al. 2002, Brewer and Gardner 1996, Burke 1980, Hoelter 1983, Kiang, Yip, and Fuligni 2008, Landau 2009a, b, Stets and Burke 2000, Stryker and Burke 2000, Stryker and Serpe 1994, Stryker and Statham 1985). Cross-case analysis and coding revealed that several individuals experienced powerful positive and negative life-shaping and life-changing experiences that led them to their present personal, cultural, and professional position in life. Jones (2009) notes the importance of these types of experiences. She observes that, “we cannot separate ourselves from the contexts in which we grew up, as these were the very experiences that influence” who we are and who we eventually become. Similarly, Stryker and Serpe (1994) explain that identity salience is aided by identity schemas. “Internal organizations of stored information and meanings operating as frameworks for interpreting experience” (18) organize and process self-related information to create cognitive generalizations about the self. This feeling was echoed by all of the individuals participating in this project but most eloquently by Lawai‘a. He observed how “all of my
experiences shape who I am…because all those experiences, positive and negative, synergistically created who I am today.”

Each of the ten individuals in this project could point to key experiences that aided them in establishing the salience of the scientist dimension of their overall identity. Incident-by-incident analysis revealed dramatic experiences had the most profound effects. Thematic coding revealed life changing/shaping experiences affecting the development, adoption, and sustainment of salience of their scientist identity. For some individuals, these powerful experiences were familial. Keli‘i noted that growing up and living with his grandmother was one of the most profound influences of his life in terms of appreciating nature, education, and the value of family and hard work. It also, as he put it, taught him to look ahead and around at what was happening in the world. “She saw the transition from the early 1900s to 1965. She saw the changes from the time she was growing up to being a much more industrial and urbanized kind of Hawai‘i.” As the last member of his family to be a native speaker “she didn’t want us to learn the culture or to speak Hawaiian. She wanted us to learn English and go to English schools because she knew that was the only way we were going to be able to succeed in society.”

For other narrators, particularly Hoku and Pōmaika‘i, the salience of what would become their professional identities was born out of health-related challenges they each faced as children. During her elementary school years, Pōmaika‘i had a slight curvature of her spine leading to physical therapy as an outpatient at a hospital in Honolulu. “Due to treatment for back issues as a child, I thought I wanted to become a physical therapist.” She selected coursework in her B.A. curriculum at the University of Hawai‘i that would eventually allow her to transfer to a physical therapy degree program on the Continental
U.S. in addition to volunteering at the hospital that treated her and forming an undergraduate student group for those interested in physical and occupational therapy. Hoku, on the other hand was diagnosed at an early age with a variety of health issues including asthma, back problems, and precocious puberty. She explained during her interviews she “was just so intrigued with why I had to do those things” and was inspired because her “own doctor was just amazing. I think I was destined (to be a doctor) but I also had the desire to go in to medicine too because he had such an influence on me.”

Just as the intersectionality models of identity stress change, fluidity, and adaptation to experience (Abes, Jones, and McEwen 2007, Bowleg 2008, Hancock 2007, Jones 2009, Jones and McEwen 2000, McCall 2005) so to do the participants eventual professional identities change based on experiences. For Hoku, her early health-related experiences started and reinforced her lifelong ambition to be a doctor despite a lack of mentors and role models. “I loved my doctor and the other specialists too…they were just such neat people. But none of them were women! There weren’t women role models and at Kamehameha they NEVER talked about women being doctors.” The American Association of University Women (AAUW) (1998), Brickhouse, Lowery, and Schultz (2000b), Brotman and Moore (2008), Carlone and Johnson (2007b), Chinn (1999b) Johnson (2007), McKinley (2005a), and Sax (2001a) note that this is one of several major obstacles preventing women from pursuing graduate degrees in science. “Due to the under representation of women in scientific careers, women students encounter fewer potential role models and same-sex mentors than men do” (Sax 2001a, 155). Hoku’s perseverance paid off and her own childhood doctor ended up being her mentor when she did her residency.
On the other hand, for Keli‘i and Pōmaika‘i, the scientist identity remained salient while the scientific focus shifted. Keli‘i, after having become interested and involved with the politics of the Hawaiian renaissance of the 1970’s, has worked tirelessly to infuse Hawaiian knowledge and culture into place-based science and math curriculum. Pōmaika‘i explained, her “desire to become a physical therapist changed when I took a genetics course in my junior year of college.” This led to an undergraduate research assistant position, genetics-based research projects that truly interested her, and presentations at scientific symposia locally and nationally. It led her away from her original plan based on childhood life-shaping experiences, her later positive experiences in genetics led Pōmaika‘i to an unintended scientist identity as well as graduate degrees in cell and molecular biology.

While unintentional, Pōmaika‘i’s involvement in a genetics course mirrors life-changing experiences had by Keala and Melemele. For these particular narrators, the scientist dimension of their identity was not as deliberate as that of Kahelelani, Kaipo, and Aloha. They did not have a long-term interest in science. Nor did they have formal or informal educational experiences leading them to enter the sciences, pursue a degree, and make a life for themselves within a science-related field.

Melemele, for example, found her way to science through her interest in food, farming, and the emergence of the Hawaiian dimension of her identity following the birth of her children. She explained during her interviews that she “didn’t plan to be in a STEM program. I didn’t say I’m going to go to school and do a science degree. I ended up being in the science program by accident…I just wanted to learn about plants.” Keala’s trajectory towards science was even more unintended. He explained that his
“interest (in science) started my senior year when I picked up a book. I didn’t have that many friends so I would hang out at the library…and read all the different books. One day I picked up a book that was about the natural history of Hawai’i and looked at all the plants and animals and that’s when my interest really started. Up until then, I knew I had an interest but I didn’t know that I could make a career out of it.”

Regardless of whether the individuals in this project deliberately or unintentionally arrived at their beautiful lives in science, they all have faced similar challenges in maintaining the scientist dimension of their identity and sustaining their interest in science.

**Sustaining Their Interest in Science**

Children are naturally curious about the world around them and the processes they use to learn whether things are hot, cold, rough, smooth, large, and small has many similarities to what some call the scientific method. Each of the participants, as explained previously, developed an interest in science early in their lives. That interest, in part, has been sustained with support from friends, family, and colleagues. In addition to the typical supports we might find in interviews with individuals of any cultural/ethnic group, many of the participants in this project have sustained their passion for science by making their career/research field personally, socially, and culturally relevant.

Hawaiian values such as community, family, and sustainability have been guiding influences on their career choices. These same values have also sustained and enhanced their interest in science, technology, engineering, and math. Reflecting their own experiences several participants spoke of the need to merge both science and culture together. Merging the two would create new research methodologies that are both academically rigorous yet relevant to Hawaiian culture and the community. Several
narrators spoke of the need to bring these two dimensions together. Keala sees “science as putting numbers, calculations, and processes that Native Hawaiians are already aware of into an English context.” Keliʻi echoed this point when he explained some similarities and differences between ancient Hawaiian and modern scientific systems of knowledge:

“The Hawaiians of old didn’t have the words or the nomenclature to understand what photosynthesis was. But they understood the causal relationships between growing limu at the bottom of a pond, utilizing the sun as a food source for that limu, and knowing that the water depth in that pond had to be only thirty to thirty-six inches for the sun to be able to penetrate so that the limu could grow well so they could feed a lot of fish in that pond. They understood the causal relationships in what we call science today. Science to me is a great way for us to understand our environment and to give meaning in a much deeper way to understand all of the interrelationships from the microscopic level to things we cannot see, feel, hear, or touch to the things that we can. When we say that Hawaiians saw things holistically, I think that is true because they looked at all of these relationships.”

Keliʻi also noted that the most important thing when merging these knowledges together is to “allow the student the opportunity to decide for themselves what is important and what is not.” A wide range of educational opportunities will showcase the individual qualities of science and culture while enabling the exploration of the intersections and interactions between the two.

Their Hawaiian identity gives the individuals in this project a unique vantage point from which they can be a bridge between so-called Western scientific methods and methodology and Hawaiian cultural knowledge and practice. The idea of acting as a bridge between science and culture was a theme that resonated between several of the individuals in this project, particularly Lawaiʻa, Keliʻi, Aloha, and Kahelelani. This concept also mirrors the merging of qualities associated with indigenous knowledge(s) and Western science described by Barnhardt and Kawagley (1998, 2005), Battiste (2002), Kawagley and Barnhardt (1998), and Semken and Frank (1997) and represented in Sellers et al. (1998) diagram on page 83.
Taking on the role of a bridge between two worlds can create challenges from both sides of the divide. However, several of the participants expressed great enthusiasm in accepting this role. Lawai’a, for instance, as a graduate student whose research seeks to merge indigenous, place-based, and scientific methodologies, proclaimed during his interviews that he “will be that bridge, the facilitator, that translator, or negotiator between both sides” noting that as both a Hawaiian and a scientist he will “be able to present ideas to each community in an understandable way.” Echoing these sentiments, Kahelelani felt “that the Hawaiian perspective can offer new perspectives in science and engineering” that traditional Western scientists may not consider.

**Facing Challenges**

While all of the narrators in this project are very passionate about their chosen STEM field, they all acknowledged encounters with members of both the Hawaiian and non-Hawaiian communities who did not share their enthusiasm for some aspects of science. The difficulties the narrators have encountered stem from a variety of factors. The first is a feeling that science is not something that Hawaiians can do. While this will be explored in more detail later in this analysis it is worth mentioning now because several of the individuals in this project recalled specific incidents during their childhood when their interest and passion for science was challenged. Lawai’a, for example, talked about the mentality many Hawaiians in his community growing up had with regards to a job or a career. “They think…I gotta be like my uncle; I have to go and be the bus driver or be the rubbish man. They think they’re not smart enough.” Keala lamented that the overall attitude in his neighborhood was that the best thing was to try for an athletic scholarship for those that were even interested or encouraged to go to college. Otherwise Hawaiian
students could work as a hula dancer at a local luau or work at a resort if you spoke really well and were handsome/beautiful.

A second challenge that will be explored in the next sub-section involves the perceived differences between science and Hawaiian cultures and questions regarding the validity of traditional knowledge by scientific community. As both the literature and the individuals in this project explain, there are distinct differences between so-called Western scientific methods and methodologies and Hawaiian culture. However, thematic coding revealed that not only do the participants find ways to navigate between these perceived differences they have found ways to facilitate the intersection and interaction of science and culture by acting as an intermediary between the two.

There is also a perceived lack of respect for Hawaiian culture on the part of scientists performing research in Hawai‘i. Aloha spoke of his role, as both a Hawaiian and an engineer, to “bring groups together, to respect each other, so each can bring different skills to the table and if we can merge them it makes for a better project.” While not a major theme during the interviews, several of the participants made mention of a legacy of distrust of so-called western science and the methods that accompanied colonization and institutional subjugation of the Hawaiian people and the land. To Kahelelani, and other participants as well, respect also translates to the places scientists go to conduct their research, the people they encounter and work with during that research, and the place-based knowledge they gain from that research. Using astronomy as an example, Kahelelani explained,

“as a Hawaiian, I want people to be respectful. I want people to come here and have respect for the resources that they’re using because I feel like a lot of the astronomers that use the facilities don’t understand much about Mauna Kea and Haleakala. These telescopes are important to their work but it’s strange to me to come and use them
without any knowledge of the place and people. I just want them to have a respect for what they’re using and what they’re gaining.”

Despite the previously mentioned challenges, all of the individuals involved with this project have made a beautiful life for themselves in science. However, discussing with the individuals in this project led the third major theme in the context of the merging of the professional and cultural dimensions of their participants’ overall identities. Almost all of the individuals in this project acknowledged that while the integration of science and culture is necessary, especially in the context of place-based research, some STEM fields are easier to connect with Hawaiian culture than others.

**Hawaiians Doing Things vs. Doing Hawaiian Things**

Cultural and spiritual connections between traditional culture and modern science highlighted by researchers including Ah Sam and Robinson (1998), Aikenhead (2001a, 2002a), Au (1998), Chinn (1995, 2008), De Souza (2007), Kana‘iapuni (2005), Kaholokula (2003), Kawagley (2006), Kawagley and Barnhardt (1998), Kawagley, Norris-Tull, and Norris-Tull (1995), Maaka (2005), and Meyer (1998a, 2001b) echoes similar themes revealed through open coding of interviews in this project. These include, but are not limited to, the incorporation of stories, myths, and legends in the description of scientific concepts, place-based curriculum, and a focus on scientific fields that connect easily and are reinforced by traditional culture (i.e. celestial navigation in the study of astronomy, fish pond management in the study of ecology). These types of connections have been shown to increase and sustain interest in STEM for Indigenous students. Focused coding, however, revealed concerns that cultural/scientific connections could limit STEM-related opportunities academically and professionally.

Recent scholarly work by both Indigenous and non-Indigenous researchers points to differences between Native and Western epistemologies. Multiculturalists like
Aikenhead (2006), Bang and Medin (2010), Gauch Jr. (2006), Padilla (2005), and Siegel (2002) call for a larger “worldview” within science textbooks and the curriculum they espouse broadening the social and cultural appeal of science. On the other hand, infusionist scholars like Brickhouse and Kittleson (2006), Cobern and Loving (2001), McKinley (2005b), Mitchie (2002), and Reed (2008) have sought to reconcile the apparent disconnect between science and indigenous knowledge by advocating for the infusion and incorporation of indigenous knowledge into the science curriculum.

Participants in this project see similarities between indigenous and scientific knowledge systems. Baker (1996) describes both systems as knowledge that “consist of a set of explanations which seek to make sense of the natural world” and involve prediction, theory formation, experimentation, and explanation (Aikenhead 2002a, b, Baker 1996). On the other hand, participants also see distinct differences. So-called Western science emphasizes qualities such as logic, rational empiricism, and compartmentalization while indigenous knowledge focuses on cohesion, participation, relationships, and sensation. Indigenous scholars like Meyer (2001b) insist that Hawaiians may need to work within the bounds of a culturally specific/appropriate and place-based “Native Hawaiian epistemology.” This would combine “both the ancient and modern, central and marginalized” (126) to avoid “the disparity between home and school environments…which significantly affect their attitudes towards” (Cajete 1994, 42) science.

Many of the narrators in this project talked about ways in which their Hawaiian culture has and does play a role in the science they do. However, focused and thematic coding of the data revealed a significant difference between the saliences of the cultural
and the professional dimensions of identity. Sing, Hunter, and Meyer (1999) support the participants’ point of view by contrasting “Hawaiian(s) doing things” versus “doing Hawaiian things” (15). This distinction brings to light two important participant understandings revealed during thematic coding of interviews. Firstly, the participants’ understanding of what it means to be Hawaiian delves deeper than superficial activities such as doing hula, eating Hawaiian food, canoe paddling, chanting, or working in a lo‘i. Secondly, the participants also understand that regardless of whether a modern scientific field connects easily to traditional Hawaiian culture, participants in this project see science as being a Hawaiian thing.

**Hawaiians Doing Things**

Cultures that have experienced both physical and existential trauma seek to recapture what was lost while acknowledging the need to move forward. The scholars Cook, Withy, and Tarallo-Jensen (2003), Cook et. al. (2005), Kauanui (2008), McCubbin, Ishikawa, and McCubbin (2008), and Osorio (2001) confess that the process of defining culture and values, healing wounds, and restoring cultural and psychological balance has resulted in friction within the Native Hawaiian community. Personal, social, and historical questions regarding what makes someone Hawaiian have raised the cultural stakes since the Hawaiian renaissance of the 1970s. The rediscovery and, in some cases, reinvention of cultural foundations (i.e. language and practice) raise dilemmas of authenticity and cultural invention, defining tradition, the role of non-Hawaiians in Hawaiian practice, and the rearticulation of Indigenous identity (Corntassel 2003, Hall 2005, 2009, Ledward 2007, Linnekin 1983, Osorio 2001, Schachter 2010). The majority of participants in this project view their professional contribution to STEM-related fields as an activity aligned with Hawaiian culture. Additionally, the majority of the
participants see their activities as scientists and members of the science community as an extension of their Hawaiian-ness.

Axial coding of the participant data revealed that at the heart of the intersection and interaction between Hawaiian and scientist identities is the question of what it means to be Hawaiian. The rearticulation of Hawaiian identity mirrors acts of self-reflection and discovery occurring within Maori, Native American, and Inuit social groups (Barker 2003, Corntassel 2003, Field 1994, Owl 1962). Using Holm et al. (2003) as a guide, Corntassel proposes that four interlocking concepts be used as a guide in the determination of indigeneity: sacred history, ceremonial cycles, language, and ancestral homelands. Sacred history includes the belief that individuals are ancestrally related to and identify themselves as descendants of the original inhabitants of ancestral homelands based on oral and/or written histories. Ceremonial cycles include (in)formal political, economic, and social institutions, which reflect their distinct ceremonies, kinship networks, and continuously evolving cultural traditions. Language invokes individuals who speak or once spoke an indigenous language even where the indigenous language is not spoken, distinct dialects exist and/or uniquely indigenous expressions may persist as a form of indigenous identity. Ancestral homelands are key to peoples who distinguish themselves from the dominant society and/or other cultural groups while maintaining a close relationship with their ancestral homelands and sacred sites, which may be threatened or may be places where indigenous peoples have been previously expelled (Corntassel 2003, 91).

Although these four concepts are far from definitive in determining an individual’s indigeneity they do create a way in which Hawaiians can begin to define themselves
culturally and build self-esteem (Arndt et al. 2002, Pyszczynski et al. 2004). They are much less arbitrary than previous definitions such as blood quantum and less fuzzy than an individual’s ability to demonstrate knowledge of so-called Hawaiian skills (i.e. language ability, hula, chanting). More importantly these four factors mirror the deeper understanding of Hawaiian identity as personified and revealed during thematic coding.

Previous curricular efforts to engage Native Hawaiians in the sciences were often done with an eye towards assimilation. More recent efforts, however, have placed an emphasis on scientific content and connect it to specific geographic locations in Hawai‘i or common cultural concepts such as malama ʻaina or being pono. For instance, the strengths-based curriculum and guidelines found in Nā Honua Mauli Ola: Hawai‘i Guidelines for Culturally Healthy and Responsive Learning Environments (2002) has focused on content and broad cultural concepts meant to appeal to Native Hawaiian students. Thematic coding uncovered that the participants themselves focus on how they, as scientists, and the science they do impacts their community. Several participants stressed that scientific content and knowledge is important. However what motivates and reinforces many of the participants is the impact that knowledge will have on the community.

A commitment to giving back to the community in some way, shape, or form resonated for many of the participants. Lawai‘a, for example, has made this value an essential part of his research, and he regularly meets with community members to share what he has found. Hīhīmanu volunteers with programs that spark interest in science with elementary and secondary students and reaches out to other Hawaiian college students in the sciences. Keli‘i’s passion for the community led him to found and
manage several non-profit organizations that specialize in the revitalization of natural resources around the State of Hawai‘i. Hoku works tirelessly within her community, as both a practicing doctor and within the UH college system, to support the next generation of doctors who are of Hawaiian ancestry.

Concerns were raised, however, with regards to organizations that place too much emphasis on the Hawaiian community and the Hawaiian-ness of individuals involved in those organizations. Kaipo verbalized the frustration, shared by multiple participants in this project, he felt during a medical school interview. “Every question they asked pertained to how I could, as a physician, help the Native Hawaiian community. They’re asking me things like, ‘how do you think your practice will help the Hawaiian culture and community.’ Yes, I’m Hawaiian. And it’s not that I didn’t want to help the Hawaiians but I wanted to be a doctor, to be a doctor. I wanted to be a doctor to help everybody, not just a doctor that helped the Hawaiian community.”

None of the participants feel they are any more or less Hawaiian based on arbitrary and artificial divisions such a blood quantum. Nor do they feel more or less Hawaiian because of their ability (or lack thereof) to participate and/or demonstrate their knowledge in so-called Hawaiian skills. None of the participants in this project base their Hawaiian identity or their indigeneity on their ability to integrate traditional Hawaiian knowledge into their profession. Instead, the pride they have as Hawaiians in science (or Hawaiian scientists) comes from how they approach the scientific field they have come to love, the scientific research and professional work they do, how they approach and work with colleagues that share interests, and how they give back to their community through their research and throughout their professional careers. These values are particularly
important to Aloha and Melemele whose generation was not unable to participate in
certain Hawaiian activities. Even for Keli‘i, who attended college during the height of
the Hawaiian renaissance, giving back to the community and treated both Hawaiians and
non-Hawaiians alike with aloha was a defining trait in what makes them Hawaiian.

Younger participants such as Lawai‘a, Kahelelani, Pōmaika‘i, Keala, and Hīhīmanu
recognize the struggles that their parents and grandparents had to suffer. As a result the
spirit of giving back and supporting their communities resonates among them in addition
to renewed desires to participate in and practices Hawaiian skills such as hula, chanting,
and speaking the Hawaiian language.

Each of the participants acknowledged that there are members of the Hawaiian
community who may not appreciate their love of science. General coding showed the
participants undergoing continuous self-reflection regarding the representation of
Hawaiians and indigenous peoples. Hīhīmanu best summarized the feelings of the
participants, which echo the sentiments of indigenous scholars such as Linnekin (1983),
Osorio (2001), and Trask (1999), as she and others in this project challenge more
established conceptualizations of Native Hawaiian identity. “Being Hawaiian,” she
described, “doesn’t come from eating Hawaiian food or even speaking Hawaiian. It
comes from what we do as Hawaiians. Every Hawaiian I know is doing something
different all the time. We can have different kinds of Hawaiians!”

Field (1994) explains that “such identities are determined through specific and
varying forms of resistance” (237-238) to both internal and external stereotypes of what it
means to be Hawaiian. Osorio (2001) laments the difficulty in trying to trace a distinct
Native identity that includes what has been lost and corrupted through colonial
assimilation and subjugation, what has been Americanized, and what has been recently rediscovered. When negotiating Hawaiian and science identities, several participants struggled with and against an “increasing demand for an adjective to describe ‘Hawaiian’ including a range of signifiers…such as ‘native Hawaiian,’ ‘real Hawaiian,’ indigenous Hawaiian,’ and even ‘Hawaiian Hawaiian’” (Khaulani 2007, 147-148). Individual and social identity is often defined by the activities we perform in relation to particular social group. Many of the participants revealed that cultural gatekeepers used their ability to do Hawaiian things as a way to gauge their Hawaiian-ness. Most of the individuals in this project participated, and continue to participate in, activities such as hula, chanting, and paddling. However their choice to pursue degrees and careers in science created friction because many in the Hawaiian community do not see being a scientist as a Hawaiian thing.

**Doing Hawaiian Things**

Like most of the participants in this project, scholars like Corsiglia and Snively (2000), Huntington (2000), Kawagley, Norris-Tull, and Norris-Tull (1995), and Meyer (1998b) hold the belief that some modern scientific fields connect more easily to aspects of Hawaiian (and other Indigenous) culture and practice because of a long cultural history. Without referring to “science” specifically, Meyer (1998b) emphasizes how the ecology of their culture influenced ways in which ancient “Hawaiians viewed utility and knowledge in their natural environment” (24). “Usefulness/utility…shape what is considered worth knowing and how this knowledge is maintained” (ibid) with emphasis on “relationship, spirituality, morality, meaning, and continuity” (27).

Pōmaika‘i, among other participants, echoed these sentiments and also noted a long history of “science” in Hawaiian culture.
“Traditional practitioners used herbal medicine for healing and knew about plants and their medicinal properties. Sea voyages were navigated using knowledge based in astronomy and geography. The ahupua’a was a thriving agricultural system with irrigated and rain-fed areas that were conducive to growing specific commodities. Fishery management systems were implemented to ensure consumption and sustainability levels were balanced.”

Participants in so-called traditional scientific fields such as astronomy (Kahelelani), biology and ecology (Keala and Melemele), marine science (Lawai’a), and medicine (Hoku) admitted that it has been relatively easy to couple their professional field with their cultural backgrounds. Furthermore these fields also lend themselves to an easier merging of ancient and modern knowledge and practices. Harding (1998) notes that “cultures are ‘toolboxes’ as well as ‘prison houses’ for sciences and technologies” (61). Despite the historical relationship these fields have with Hawaiian culture, participants in these fields raised two important considerations. First, being Hawaiian did not dictate their initial interest in these particular fields. Kahelelani expressed this succinctly. “I am Hawaiian and do astronomy but I didn’t get into astronomy because I’m Hawaiian.”

Kahelelani’s attitude supports the importance of the participants’ second point conveyed by Keala, “if we’re learning science it’s from a Western perspective.” A theme of potential disconnection between scientific and traditional Hawaiian cultures that was revealed through focused coding resonated for several participants. Scholars have argued that a way to incorporate Indigenous knowledge into the science curriculum is by adding the word “science” (i.e. Native science and Indigenous science). Several of the participants acknowledge the importance of indigenous science and infuse it into their own scientific research. Lawai’a, for example, has sought to “marry both types of data and match traditional ecological knowledge (TEK) with contemporary scientific data.” Lawai’a hopes the incorporation of TEK will provide a broader range of data for his research, encourage more active indigenous student participation, create value for
indigenous knowledge for non-indigenous students and scientists, and “make a demonstrable difference in many research projects and management strategies” (Huntington 2000, 1273).

According to the participants, these elements should not minimize the impact of their Hawaiian identity on their scientist identity. Instead, they should broaden the perspectives of both the scientific and Hawaiian communities. Additionally, it should encourage others to look beyond superficial scientist and Hawaiian connections and explore STEM-related fields that may not lend themselves as readily to cultural connections. These include, but are not limited to, cell and molecular biology (Pōmaika‘i), chemistry (Kaipo), and engineering (Hīhīmanu and Aloha).

The challenge, discovered through focused and thematic coding, is not necessarily in the development of their scientist identity but in the recognition of the value of that identity by others that share their sociocultural identity. As social creatures, the human species has adapted to group living with varying levels of social identities that depersonalize the concept of self into more inclusive social units (Arndt et al. 2002, Brewer 1991, Brewer and Gardner 1996). Despite multiple layers of social identities there also exists the personal identity consisting of “those characteristics that differentiate one individual from others within a given social context” (Brewer 1991, 476). “The distinction between interpersonal and collective identities is not simply a matter of the difference between attachments that are based on affect and attachments that cognitively based. Both…involve affective and cognitive categorization” (Brewer and Gardner 1996, 83).
The construction of the participants’ scientist identity, as noted previously, is influenced by the social dynamics of an individual’s experiences including both supports and challenges. Burke and Reitzes (1981), Carlone et al. (2008) and Gee (2001) note that identity construction requires the participation of others and that a particular kind of person requires that we do things within that identity that would be recognizable to others. Neither the scientist nor Hawaiian identities is an exception to this concept. Social identity and social identity theory is often associated with self-esteem and the consequences of being included or excluded from membership to a particular social group or category. “Someone who has a science identity, demonstrates competent performance in relevant scientific practices and deep and meaningful knowledge and understanding of science, and recognizes herself and gets recognized by others as a ‘science person’” (Carlone and Johnson 2007b, 1190-1191). “One’s actions, words, and appearances thus become significant symbols…indeed, it is the symbolic and the reflexive characters of an identity (and self-concept)” (Burke and Reitzes 1981, 84) that allow it to intersect and interact with other identities.

Several of the participants spoke of occasions when their interest in science was challenged because it was not viewed as being a Hawaiian thing. Participants responded to these challenges with the question “what are Hawaiian things?” Are they things that Hawaiians can do? Are they things that only Hawaiians can do? Are they things that people can and/or will recognize as being Hawaiian? Are they things that only Hawaiians can and/or will recognize as being Hawaiian? The participants in this project believed these questions are key to finding balance between their individual identities as well as the intersection and interaction of their Hawaiian and scientist identities.
Fortunately, there are historical precedents to support Native Hawaiian interest in science beyond so-called traditional scientific fields. King Kalākaua and the Hale Nauā society is one such example. During her interviews, Kahelelani spoke passionately about King Kalākaua “wanting Hawaiians to be at the forefront of any scientific field and to be competitive with the rest of the world. He really wanted to make sure that happened, and I like to think that he would have wanted that continue.” Kaipo echoed this belief. “I’ve never understood the mentality ‘I’m Hawaiian so I have to do this or I can’t do that.’ I can’t understand why people will use culture as a reason for doing some things and not doing other things.” From a historical perspective it is understandable that sciences that connect easily with “traditional knowledge” (i.e. biological/life and earth/space sciences) would reinforce the participants’ Hawaiian identity. “Tradition” as Linnekin (1983) “is fluid; its content is redefined by each generation and its timelessness may be situationally constructed. From an informant’s point of view, ‘traditional’ may mean times long past or what one’s mother did” (242).

Nonetheless all of the participants in this study, as well as literature such as Chinn (2005, 2011) and Kana‘iaupuni (2005), noted that ancient Hawaiians were very skilled in what is now called the sciences. This includes agriculture, astronomy, classification, engineering, and navigation. Individuals involved in these “traditional sciences” should therefore feel both their Hawaiian and scientist identities reinforced while those involved in more “modern sciences” may feel their Hawaiian identity undermined. However, focused coding of the data revealed a majority of the participants felt that their scientist identity reinforced their Hawaiian identity regardless of whether their chosen scientific field connected “easily” to their culture. This is due, in part, to the participants’ view of
both their Hawaiian and scientist identities as deeper and more profound than what others may be able to recognize.

The unique relationship between Hawaiian culture and the “culture of science” has led to the development of several supportive and collaborative STEM-based groups at the University of Hawai‘i. Just as Hurtado et al. (2008) explore, students in these groups “were able to develop their science identity at the same time that they maintained their racial identity” (21). Several participants commented that these groups have been instrumental in helping them to find balance and have helped inspire them to pursue graduate and advanced degrees in STEM-related fields. Pōmaikaʻi, personifying this attitude, explained that regardless of the scientific field, “obtaining a degree in science is right in line with Native Hawaiian scholars that preceded me.” In this way, according the participants in this project, doing science and having a healthy scientist identity is a very Hawaiian thing.

Coding of participant data revealed not only what the participants perceive their identity affiliations to be, but also how they make meaning of those affiliations. Knowing the relationship between potentially competing social groups and identities provides a deeper awareness of how Native Hawaiian members of the STEM community understand themselves. As a result of their own understanding of themselves and the intersections and interactions of their identities, the participants can effectively navigate between social groups, determine salience or relative unimportance, and merge identities when necessary. In addition, participants can also bridge gaps between the Hawaiian and scientific communities.
Being a Bridge

Through both active adoption and reinforcement, the participants in this project personify the interactions and intersections of both the Hawaiian and scientist identities.

Hoku noted that,

“being in science is like any other profession. You’re enticed by it’s basic elements. Whether it’s math or science and there’s always ways you can find analogies in your culture that makes that science and math components connect. I think you try to find some connections that help you to continue who you are culturally in that pursuit of that area that you’re interested in science.”

As members of each social group, their identity “derives from a fundamental tension between human needs for validation and similarity to others and a countervailing need for uniqueness and individuation” (Brewer 1991, 477). While Hawaiian + scientist ≠ Hawaiian scientist, data revealed that the majority of participants have successfully integrated both these identities. Additionally, participant data revealed that they see themselves as individuals who can bridge gaps between the Hawaiian and science communities and social groups.

Lawai’a, for example, proudly exclaimed during his interview that he “will be the bridge, the facilitator, that translator, or negotiator between both sides.” Many of the participants felt that both the science and Hawaiian communities often have the same goals but approach them in different ways. As members of both communities, the participants acknowledged that they have the potential to be leaders in both communities and to help bring those communities together. In this vein, some of the participants, however, sense the emergence of a new kind of identity within themselves and in the larger Hawaiian/STEM communities. Just like the scientific research they are engaged in, many of the narrators find themselves on the cusp of a new identity that is both inspiring and terrifying. The participants, therefore, are what Keating (2006) would call threshold
people. “They move within and among multiple, often conflicting, worlds and refuse to align themselves exclusively with any single individual, group, or belief system…to develop innovative, potentially transformative perspectives (respecting) the differences within and among the diverse groups and, simultaneously, posit commonalities” (6). The ability to move between social groups and identities is, according to participant data, a double-edged sword.

Conversely, several participants commented on the pressure it puts on them to be successful in science. Many feel that they are not only representing themselves and their families but the entire Hawaiian community. Keala, for example, feels pressure because members of his own family and many in the Hawaiian community “have never gone to this level of education or have thought of professions outside labor or some kind of low-skill type of profession.” Additionally some participants spoke of pressure to make connections between science and Hawaiian culture that may not necessarily exist. “Astronomy,” as explained by Kahelelani, “is a large part of Hawaiian culture. I feel like we should try to link the Hawaiian and astronomy a little bit better but at some level its physics. It’s not Hawaiian.”

On the other hand, this new Hawaiian/Scientist identity also satisfies the need for individuals to be similar yet distinct from the Hawaiian and scientist social groups. The interacting, intersecting, blending, and merging of Hawaiian and scientist identities creates multiple avenues for achieving self-esteem as well as optimal distinctiveness (Arndt et al. 2002, Brewer 1991, Brewer and Gardner 1996, Pyszczynski et al. 2004). For the participants, science is more than simply a matter of memorizing the periodic table, the names of planets, and understanding processes and scientific terminology. Kozol and
Osborne (2004) note that “science is a world in its own right that, upon entering, the student can join membership…setting them apart” (174). However, the participants have created “individuated meaning (in science) thereby increasing, substantiating, and authenticating their relationship with people, nature, and the natural world” (ibid). By doing so, the participants themselves become an intermediary they can help to establish stronger relationships between potentially competing social groups and identities. Hoku, for example, has had to become a cultural “chameleon.” She has found it easier to use “pidgin with certain situations out on the west side to be able to get a message across for either patients or community presentations so that it seems more accepting that I’m one of them. That way they don’t feel so intimidated.”

Thematic coding of the data revealed that the participants see their understanding of multiple epistemologies as a benefit. Their unique status as Native Hawaiian members of the STEM community offers them a unique perspective. According to the participants, this allows them to “conceptualize and demonstrate alternative understandings of nature emerging from various studies and methodologies as well as ways they may play out in learning” and research contexts (Bang and Medin 2010, 1017). Keli‘i noted that his ability to navigate both worlds “allows me the opportunity to build universal bridges between people.” Aloha shared Keli‘i’s belief. “I try to bring people together…it goes back to relationships and respect for individuals and working with them.”

Several participants currently involved in scientific research projects felt the merging of identities, methodologies, and epistemologies is going to be the future of ecological and economic management decisions both in Hawai‘i and in the world. Participants noted that as members of both communities, they have important roles within both the
Hawaiian and science communities. These include speaking on behalf of one community for the other, to bridge gaps, smooth over misunderstandings, and to be a leader for future generations of scientists. Relating his experiences, Aloha found a key to success is integrating “the Hawaiian perspective of inclusiveness and communication into the analysis of a problem and the decision making process.” According to the participant data, their ability to make meaning in science and to create an individuated scientist/Hawaiian identity will allow them to be a powerful voice within both communities. Reflecting on her as a student and professional scientist, Kahelelani felt that being Hawaiian “offers a different perspective in science and engineering that other people might normally take and gives you a more diverse set of tools to use and apply.” Conversely, participants like Hoku, Melemele, and Kaipo also felt that science also offers new perspectives on traditional knowledge to the Hawaiian community.

For many Hawaiian students, science is portrayed and approached as a set of unchanging facts, laws, and theories that can seem completely alien from the reality they experience through their home culture (Baker 1996, Bang and Medin 2010, Barnhardt and Kawagley 1998, Kana‘iaupuni 2005, Kozoll and Osborne 2004). More importantly, being an intermediary allows the participants to be role models and inspire future generations of Native Hawaiians interested in pursuing science degrees and careers.

First Generation Native Hawaiian Scientist

All of the participants in this project represent the first generation of their family to attend college. They are also the first to pursue degrees and careers in science. Earning a degree in a STEM-related field is not easy. Research shows that while the same percentage (44%) of college-bound minority and major (white/American) students indicated their intent to major in STEM-related fields only 27 percent of
underrepresented minority students and 46 percent of majority students obtain a scientific
degree (Grandy 1998, McCarron and Inkelas 2006, Malcom, Hall, and Brown 1975, Sax
2001a). Hurtado et al. (2008) notes that if “the nation’s colleges and universities are to
graduate the next generation of research scientists, they must be aware of the number of
racial/ethnic minorities in the science pipeline” (190). Though dismal, the rates of
undergraduate completion for minorities in science has been increasing steadily due to
undergraduate research opportunities, increased college/university efforts, support
programs, and a steady stream of federal funding (Atwater 2000, Cole and Espinoza
2008, Dennis, Phinney, and Chuateco 2005, Hurtado et al. 2011, Phinney and Haas 2003,
Russell and Atwater 2005).

“Increased participation in science-related careers (i.e. medicine, dentistry, and
engineering) can offer (Native Hawaiian) students opportunities for both social and
economic mobility, especially as many of these students are disenfranchised, oppressed,
and marginalized” (Gibson 1991, 691). The participants in this project not only represent
the first generation of scientists among their families and friends; in most cases they are
also the first generation to attend college, let alone obtain advanced degrees. Brown
(2004) emphasizes the importance of this perspective since

“Despite a wealth of available research on cultural conflict for ethnic minority students,
ethnographic studies of students’ challenges (in science), including the discourse of
classrooms, have been constrained in view of the fact that researchers’ use of macro
perspectives of ethnic identity underemphasize the implications of students’ individual
agency. Although broad analyses of the challenges of ethnic minority students’ cultural
assimilation provide useful generalizations about their experiences, examinations of
individual identity can provide insights about those who have differential experiences
with cultural assimilation” (811).

Being one of the few, and in some cases, the only, Native Hawaiian in the classroom
and laboratory presented each of the narrators with unique challenges. “All minority
students face substantial barriers in school, however, relating most notably to the
prejudiced attitudes of the majority or dominant group toward minorities…home-school culture discontinuities…and assignment to schools of a quality far inferior to those attended by majority-group agemates” (National Science Foundation 2013, 357). Once students surmount these obstacles “and ‘make it’ into the academy, they, like other (students) of color, face yet another set of obstacles, including experiences of racial tokenism, overt and covert racism, and stigmatization. (Niemann 1999, 111). As a nonimmigrant involuntary minority, Native Hawaiians and other indigenous peoples “have contended with a dominant society’s hegemonic agendas imposed on their culture and daily lives” (Jester 2002, 1).

The participants in this research project, and other underrepresented minorities in the sciences, persevere and excel in spite of these obstacles. Coding revealed ways in which they turned challenges into opportunities with support from family, friends, their community, mentors, as well as both formal and informal peer cohorts. This is consistent with findings from researchers such as Bonous-Hammarth (2000), Carlone and Johnson (2007b), Chinn (1995), Cole and Espinoza (2011), Crisp, Nora, and Taggart (1993), Dennis, Phinney, and Chuateco (2004), Grandy (1996), Hurtado et al. (2008), Johnson and Arbona (2006), Johnson (2007), McCarron and Inkelas (1999), McCubbin, Ishikawa, and McCubbin (2008), and McKinley (2005a, 2008), and Tavares (2008). Further coding of data revealed consistent experiences across the ten participants’ experiences related to being the first generation of their families to pursue higher education, let alone a degree in science. These experiences have been grouped together into four sub-themes: breaking of barriers and the challenging of stereotypes whilst navigating the uncharted waters of
higher education, Hawaiian and science communities, experiences with both alienation and tokenism, and finding support for their interest and passion for science.

**Navigating Uncharted Waters**

Educational inequity is a common theme with indigenous peoples, including Native Hawaiians, and mirrors that of other underrepresented minorities in the sciences (Brotman and Moore 2008, Chinn 2002, McDermott 1995, Gibson 1991). Kaipo pointed out in his interviews that due to previous inequities, many Native Hawaiians lack “historical support” as Native Hawaiian students pursue degrees in professional fields.

“A friend of mine is a PhD and a professor. His dad’s a doctor and his dad’s dad was a doctor too. There’s a lineage, a history, within that family of going to college, grad school, and going into a professional field. I think we (Native Hawaiians) are at a disadvantage there. My generation is one of the first to really have the ability to go to college. Neither of my parents considered it and in my grandparent’s generation it was unheard of.”

Coding revealed how the lack of familial experience in attending college, attaining higher education degrees, and entering a professional field presented unique challenges. Thematic coding revealed two main sub-themes across participant experiences—challenges resulting from inexperience in the processes one needs to go through when applying to college as well as for loans and scholarships; and challenges regarding children who excel and exceed the educational levels of their parents. These sub-themes mirror research with other first-generation minority college students such as Latino/a and African-American students (Cole and Espinoza 2008, Lee 2007, McCarron and Inkelas 2006, Rochin 2007, Zalaquett 1999). “The ability of first-generation students’ parents to be involved may be constrained by a host of other variables that accompany ‘first-generation’ status, such as lower SES, fewer resources, less parental integration into the professional workforce, and less familiarity with the college-going process” (Zalaquett 1999, 537).
Almost all of the participants commented on the high value their parents placed on education. Keli‘i remarked that, “my parents and my grandmother believed strongly in education. Neither of my parents went to college so I was the very first, and it wasn’t an option.” Hoku concurred with this sentiment when she shared how “education was always a priority. My mom felt that that’s what you do.” However, participants such as Aloha, Kahelelani, Pōmaika‘i, and Lawai‘a spoke of how their parents did not understand the steps that were necessary for them to attend college. Kahelelani explained that her parents “weren’t really the ones that were pushing me to do college. I wanted to go to college and they definitely wanted me to go and were supportive of me. My parents just tried to do their best to help me.” Keala and Melemele, on the other hand, while not actively dissuaded from attending college did face some criticism from their parents who did not see value in higher education. Having raised his own children and encouraged them to attend college, Aloha reflected that, “when parents don’t see the value, in going to college or being successful, then it’s really hard to get kids to see it.”

Keala, a public high school graduate, shared his frustrations regarding the lack of support he got from his high school counselors. “It wasn’t until a week before I graduated that anyone told me how to go to college. I didn’t even take the SATs! Why didn’t anyone tell me about this?” Analysis of participants who attended and graduated from public schools revealed exasperation in their perception that certain college-prep classes were not offered as frequently as their private school counterparts. Additionally, they felt they were often not given an adequate level of academic support and advice in terms of continuing their education.
Interestingly, Hoku’s experiences mirrored Keala’s despite having graduated from Kamehameha schools. She noted during her interviews that she “wanted to be a doctor but didn’t know how. There were no mentors. There were no women role models and they never talked about women being doctors. I was kind of ignorant about what to do and my parents didn’t know how to guide me either.” Cross-case analysis of participants who attended and graduated from private school found that while many participants felt challenged by the curriculum, they did not feel supported because they were not aggressive students. Several participants felt overlooked because they were average—doing well enough in their schoolwork to get good grades but not so exemplary as to stand out in the crowd.

Whether it involved learning the steps to apply to college or making the grades to be accepted, all of the participants developed varying degrees of self-motivation and self-reliance (Atwater 2000, Grandy 1998, Hurtado et al. 2008, Phinney and Haas 2003, Russell and Atwater 2005). Many took it upon themselves to learn the steps that were needed to attend college and achieve their goals of higher education and post-secondary degrees. In her interviews, Kahelelani related how her parents were supportive “but I just took the initiative on myself. I was really the one that was gung ho about it.” Once there, participants found both new social and academic opportunities as well as preconceived notions of ability and status waiting for them.

**Breaking Barriers and Challenging Stereotypes**

The very nature of being an underrepresented minority person in a STEM related field presents participants with opportunities to break barriers created and reinforced by the culture of science and to challenge stereotypes related to Hawaiian students. As discussed previously, this project found that the majority of participants maintain a
consistent level of salience for both their Hawaiian and scientist identities. However, as students, researchers, and professionals in STEM-related fields they have also bought in the “rules of the scientific method while at the same time uphold subsequent standards of the scientific community” (Hurtado et al. 2008, 194). Students majoring in science often experience their first significant obstacle in the form of introductory “gate keeper” courses. Gatekeeper courses have been shown to disproportionately affect underrepresented minority students due to substandard high school preparation, pedagogical practices, intense competition, and lack of engagement (Thompson and Bolin 2011, Noë 2013, Anzaldúa 2002, Frank 2013).

Gatekeeper courses are meant to “weed out” students whose competence in science is allegedly not sufficient for success. The participants in this project have all persevered through such courses but not without being affected by attitudes of their professors. Lawai’a, for instance, was given the impression by his professor that he should consider going into a different field. Instead, when he did not receive the grade he wanted for that particular course, he retook it with the same professor to prove that he could get a better grade in that class. This mirrored an experience Aloha had in college when he received a “C” and was determined to get online “A’s” from then on.

**A Brown Face in a White Coat**

Focused coding revealed that participants’ experience in scientific degree programs included occasional experiences of social/cultural stigma and negative stereotyping. These stereotypes, according the participants, came from professors, peers, colleagues, and members of the Hawaiian community and challenged the participants in different ways. Each participant recalled different degrees and types of stereotypical
categorization. Lawai’a, Keala, and Hīhīmanu’s experiences had to do with the perception of their intelligence and ability as Native Hawaiian students. Hīhīmanu commented that members of the STEM community are “surprised to learn that I’m Hawaiian, especially in engineering, because there are so few of us. It just feels like we’re not expected to succeed or to be smart or to be able to do good things.” Hīhīmanu’s experiences, like other participants, have been compounded by the fact that there are few, if any, Native Hawaiian professors in the sciences.

Lawai’a reflected upon this and commented that the stereotype that Native Hawaiians have to contend with is “that Hawaiians are the groundskeeper, the janitor, the construction worker, the hotel worker—all those base salary or minimum wage jobs.” Keala built upon these comments explaining that he was rarely encouraged to seek higher education. “No one ever said you should go to school and be a doctor or a botanist. It was always you should be one of those people that work at the hotels because you speak so well. Or that I should work at a luau because I danced so well.” Comments like these, according to the participants, made them feel inferior.

Barriers to Native Hawaiians and other underrepresented minorities in the sciences have led to the creation of higher education programs that target Native Hawaiians for entrance to degree programs for which they may not otherwise qualify. Hoku, a beneficiary of such a program, celebrates the opportunities that were opened up to him. “There are so many more barriers that the Native Hawaiian kids have to overcome to even be able to compete (in the sciences). Hawaiians are the poorest of poor. How can you get them college ready when they’re not able to have food on the table or light to do homework?” Programs like this, participants argue, give Hawaiian students the chance to
demonstrate that they can handle the academic intensity of higher education and create diversity within STEM-related fields.

On the other hand, Kaipo emphasized his desire to do things in science that both he and others could be proud of regardless of his ethnic and cultural background. He and other participants admitted that being Hawaiian does give some advantages with regards to scholarship applications, grant money, and, in some cases, entrance to degree programs. However, he explained, “I’d want to be good at it whether I was Hawaiian or German or English or Chinese or Japanese. I don’t want to be accepted just because I’m Hawaiian. I want to be accepted because I’m of the same caliber as everyone else going there.” Other participants also admitted that their cultural identity probably opened doors for them including research positions, grants, and scholarships with several encouraged by college and career counselors to emphasize their Hawaiian identity. This mirrors experiences of Latino/a students who were told to use their Hispanic names as much as possible (Dennis, Phinney, and Chuateco 2005, Hurtado et al. 2011, Gándara 2006, Hurtado et al. 2008, Rochin 2007, Zuniga 2005) and is similar to racial/cultural experiences of other minority college students including African-Americans/Blacks (Atwater 2000, Cheryan and Bodenhausen 2000, Johnson 2007, McDermott 1995, Norman 2001, Stewart 2008), women (Malcom, Hall, and Brown 1976, Niemann 1999, Sax 1996, 2001b), and Indigenous/Pacific Islanders (Chinn 1995, 2002, McKinley 2005a, 2008).

“The assumption that URM students’ access to research and other academic opportunities depends more on their identity than on their academic qualifications was reflected in the piece of advice that another student from UNM received from a faculty member. He shared, “I had a professor that...was encouraging me...he was like, ‘You need to ride that [Hispanic] surname for everything that it’s worth’” (Hurtado et al. 2009, 205).
During his interviews Kaipo said that he understands the purpose of programs specifically geared to opening doors for Native Hawaiian students in science and engineering. However, he worries that they perpetuate stereotypes that many Native Hawaiian students and scholars are working to overcome.

Being one of the few, or only, Hawaiians in science also created a set of expectations related to cultural knowledge. Melemele countered the assumption “that I should automatically know some things because I’m Hawaiian. There was a professor once that expected me to know about kalo. He said, ‘You’re Hawaiian aren’t you? Shouldn’t you know about kalo?’ I’m thinking, ‘Yes I am Hawaiian and perhaps I should know about it, but it doesn’t mean that I do.’” These experiences mirror those explored by Native Hawaiian scholars such Chinn (1995, 2002), Osorio (2001), and Tavares (2003, 2008). Kahelelani also described her experiences of false expectations of non-Hawaiians. “There’s an expectation. I get embarrassed sometimes because I don’t know certain things about my culture. There’s just a lot of things that I feel like I should know and I don’t.”

Comments and stereotypes such as these from the science community were not altogether unexpected. What was unexpected, as revealed through thematic coding, was a high level of stereotyping and criticism of these views from within the Hawaiian community itself. One of the effects of such negativity and stereotyping from the Hawaiian community is that it perpetuates a sense that, for example, Hawaiians do not have what it takes to be scientists.

Hīhīmanu reflected upon her experiences and commented on how “the majority of Hawaiians I’ve talked to didn’t even know that they could do that (STEM). They’re not
even expecting it from themselves and they’re thinking they can’t do it before they even try.” Kahelelani, Lawai’a and Pōmaika‘i echoed Hīhīmanu’s frustration when talking about their experiences as graduate students. Pōmaika‘i explained that “when I told people my degree was in the sciences, they were surprised because they assumed it was in Hawaiian Studies or Hawaiian Language.” Melemele and Keala, undergraduate students, the stereotype of a Hawaiian was someone “who danced hula, worked in a lo‘i, who is brown, and most likely lived on homestead land” has changed since they have gotten to school. Keala explained, “I could see that Native Hawaiians were extremely intelligent and did a lot of diverse things in diverse fields. It empowers me to be the same way. It really raised my own self-awareness of who I am, where I came from, and what my people did.” Building on Keala’s comments, Melemele also noted that, “coming to school and learning about the history of Hawai‘i in Hawaiian studies broke my heart but it opened my mind too. It inspires me because it helps me to understand the world and it helps me to be more aware of what’s going on around me.”

**Reaching Beyond Their Parents’ Experiences**

In addition to the aforementioned social, historical, familial, and academic challenges, coding also revealed a psychological challenge of reaching beyond parental experiences—a theme consistent among underrepresented minorities in higher education and the sciences (McCarron and Inkelas 2006, Zalaquett 1999, Lippicott and German 2007). Concern over stereotypes was a repeated theme throughout the participant interviews. The jobs held by many of the participant’s parents and grandparents were labor intensive and required little to no formal education. All honored their parent’s ability to provide for the family, but the labor-intensive jobs described in interviews held little appeal for
the participants. As first generation college students, all of the participants in this project have had the opportunity to go beyond previous generations of Native Hawaiians, particularly their own parents and grandparents, educationally. Keli‘i, Lawai‘a, Keala, Hoku, Kahelelani, Kaipo, and Aloha all noted that the academic rigor combined with new social freedoms created difficult circumstances for them.

Hoku, Keli‘i, and Lawai‘a touched on an issue, which they believe is one factor affecting the number of Native Hawaiians in higher education despite increases in scholarships and academic support programs. Kaipo felt that this is one of the main reasons that there are not many Native Hawaiians in science classes and labs in particular. If their parents did not take advanced, academic track classes, then their children would be more likely to feel pressured to pursue a “job” as opposed to a career.

**Being Alone and the Token Hawaiian**

Participants in this project were one of a few Native Hawaiian students in their respective field of study. The number of Native Hawaiian and underrepresented minority students pursuing degrees in science-related fields is on the rise (Brown 2004, Malcom, Hall, and Brown 1976, McKinley 2005a, Malcom, Hall, and Brown 1975, Smyth and McArdle 2004, National Science Foundation 2013, Sax 2001a) coding and cross-case analysis revealed that being “one of only five brown people in the classroom” or laboratory led to feelings of insecurity, alienation, and isolation as well as instances of tokenism. These experiences mirror those of other minority and/or first-generation college students (Tseng 2004, Phinney, Dennis, and Osorio 2006, Zalaquett 1999, Orbe 2004, Rochin 2007, Zuniga 2005).

Hawaiian identity salience among the participants has certain advantages including access to culturally specific programs, support systems, scholarships, grants, and
internship opportunities. Being Hawaiian, according to the participants, also enables individuals to offer a different perspective and to be a bridge between Hawaiian and science communities. However, focused coding revealed several disadvantages experienced by the participants. While the aforementioned scholarly literature tends to focus on stigmatization as well as overt and covert racism experienced by students and professionals in science, cross-case analysis of participant interviews revealed few of these kinds of traumatic experiences. Initial coding uncovered Pōmaika‘i and Lawai‘a were the only participants in this project to experience any overtly racially charged comments from others.

Lawai‘a, for example, inferred from a professor’s comments that he should change majors. Instead, Lawai‘a seized that moment as an opportunity to prove that professor wrong. Also along those lines, Pōmaika‘i spoke of comments made by a colleague she trusted to review a scholarship packet. They said, “I really looked good on paper and then mentioned something about affirmative action policies.” According to her, negative comments like those made her question her self-worth as a Native Hawaiian and a scientist. In another example, she spoke of graduate students and professors wanting to call up minority program leaders and “ask them about the selection process and how rigorous it was.” Rather than giving up and giving in to the emotional pressure caused by these types of comments both Lawai‘a and Pōmaika‘i went on to receive advanced degrees in science. Researchers such as Atwater (2000), Carlone and Johnson (2007b), Gibson (1991), Helms (1998), Johnson (2007), and Russell and Atwater (2005) have found that underrepresented minorities, including women and those with disabilities, often face obstacles in science and engineering classes. Science is frequently portrayed
as being neutral to race, ethnicity, and gender. “Science,” according to Johnson (2007), “is presented…as though an individual’s characteristics are irrelevant. What is important is one’s scientific acuity. This may result from the best of intentions on the part of the professors. However, these intentions often backfire” (816). Hurtado et. al. (2011) goes further by noting that “when science faculty do not account for how the science learning environment may be more negative for (students) of color…it likely discourages them from further pursuing their science major” (557).

Initial coding on this topic found that a lack of connection to the professors and the course content led to assumptions that no personal characteristics were important in science. Personal and cultural characteristics and connections are extremely important to the majority of the participants in this project. Solomon, Greenberg, and Pyszczynski (2004), and Walsh and Smith (2007) stress that such oppositional worldviews can create self-esteem issues as individual navigate and reconcile individual and group identities. Further focused coding showed that participants developed feelings of isolation and loneliness resulting from being one of a few or the only Hawaiian in their science classes/labs as well as feelings of tokenism by professors, mentors, and advisors.

One Is The Loneliest Number

Further thematic coding of participant interviews identified a range of emotions related to their being one of the few or the only Hawaiian in their respective fields. On the one hand, most participants see their minority status as a positive quality. Most of the participants use it as an opportunity to show both Hawaiians and non-Hawaiians alike that Hawaiian students are capable of succeeding in the sciences. Keli‘i, for example, continues to use his “brown skin” to his advantage. “I guess where I’ve seen and
experienced the greatest advantages is when I’m in an environment that has very little brown skinned people.” He further explained that when travelling to the Continental U.S., Asia, and Europe for business he takes his suits. He also takes an ukulele and creates teachable moments in which he can educate others about Hawai‘i and the Hawaiian people. Many also saw opportunities to form long-lasting friendships with other minority students in their classes.

In addition, almost all of the participants revealed that being a Native Hawaiian in STEM affords them both a certain amount of status. Lawai‘a elaborated, “I felt that there were few (Hawaiians) who could go into the sciences and take their culture with them. There’s a niche that I can fill.” It also creates a lot of responsibility. Expanding on this idea, Aloha mentioned that this responsibility has been a driving force for him as both a parent and member of the Hawaiian community. “I feel an obligation to the community and to help people.” Echoing Aloha’s sense of obligation, Keala takes his responsibility personally. “I just feel like I have to set an example. It’s a lot of pressure. But I really want to be someone’s role model. I want to be that for my family and for my community. I want other Hawaiian kids to see me and think, ‘I can do that too!’”

One the other hand, many of the participants spoke of the challenges they have faced as Hawaiian students in STEM. Although the number of Native Hawaiians pursuing STEM degrees is increasing, the number of Native Hawaiians pursuing advanced degrees is still alarmingly low when compared to their Caucasian and Asian peers. The National Science Foundation’s 2013 Report Women, Minorities, and Person’s with Disabilities in Science and Engineering reported that “underrepresented minorities’ shares of science and engineering bachelor’s and master’s degrees have been rising over the past two
decades since 1991, with shares of doctorates in these fields flattening well below 10 percent after 2000” (5). Many of the participants noted that scientists do a good job of alienating and isolating themselves from the broader society. However, ethnic/cultural isolation experienced by the participants can make academic achievement even more difficult.

One of the main challenges revealed during cross-case analysis of participant interviews is the lack of emotional and psychological support friends, colleagues, family, and peers of similar backgrounds. The Kuali‘i Council Native Hawaiian Student Services reported that the “University of Hawaii system wide data for 2005 indicates that Native Hawaiians were 13.8 percent of the student body population” (Services 2006, 2). Students attending colleges with lower percentages of underrepresented minorities in science, math, and engineering experience difficulty in acclimating to university life and expectations (Bonous-Hammarth 2000, Cole and Espinoza 2008, Crisp, Nora, and Taggart 2009, Hurtado et al. 2008, Dennis, Phinney, and Chuateco 2005). All of participants commented on how hard college has been for them, particularly the first two years. Age of students in college, first opportunities to be away from home, new freedoms, and new social opportunities are all contributing factors to the typical challenges faced by students during the first two years of college. Cohorts for Native Hawaiian students in STEM-related degrees provide formal support for both a broad spectrum of STEM students as well as focused support within particular degree fields. Analysis found that many of the participants in this project are associated with a support group in one way, shape, or form and this theme will be explored in the next section.
Further analysis along these lines showed that informal support, however, was lacking for several of the participants. For example, a Native Hawaiian program that Hoku works for enables up to thirty Native Hawaiian students to pursue medical degrees via an alternate path from traditional medical school entrance. However, when Hoku went through a similar program she was only one of three. According to her, she felt supported by the professors and friends in her program but not by other Native Hawaiian friends. They “made me feel as if I was silly for pursuing (medicine).” “Because college attendance represents a departure from the pattern established by family and friends, they may become nonsupportive” (Zalaquett 1999, 417-418). As she discovered, that bond can be difficult to explain to others who have never had those experiences. Keala echoed Hoku in that he felt isolated from members of his family and community because of his intelligence and interests. “I always felt like I was on a different level than other people.” As graduate students, Lawai‘a, Pōmaika‘i, and Kahelelani felt these same effects. “A disadvantage” of having so few Hawaiians in graduate science programs, according to Lawai‘a, “is that I don’t really have anybody in my field to talk to who’s Native Hawaiian that can really understand some of the stuff I’m going through.” Pōmaika‘i was of the same opinion with regards to graduate level experiences. “When I was writing my dissertation, I felt very isolated because that is what I did every day and night for a long period of time.”

To make up for the lack of Native Hawaiians in their respective programs, many of the participants have made it a point to make friends with other underrepresented minorities, particularly those from Oceania, Samoa, New Zealand, and Micronesia. Formal support systems such as cohort programs and student STEM organizations
provide emotional and academic support. However, the lack of informal support can sometimes lead to exploitive situations in which students can be used to demonstrate the diversity of their programs.

**I Was The Poster Child For Diversity**

The multiethnic identity of the participants in this project is representative of the diversity of Hawai‘i as a whole. That diversity, however, does not exist in science, technology, engineering, and math-related fields. Despite efforts to increase the numbers of students in science majors, Hawaiian students are still underrepresented in the sciences (Chinn 2002, 2006-2007, Schools 2009, Services 2006, Stender 2010). Degree programs at the university have sought to create diversity through measures such as affirmative action, scholarship programs for underrepresented minorities, minority student cohorts, and targeted peer/faculty academic mentoring (Hurtado et al. 2008, Hurtado et al. 2011, Brown 2004, Dennis, Phinney, and Chuateco 2005, Monhardt 2000). Unfortunately, college and university degree programs use minority students as poster children for the success of their efforts at creating diversity. Hurtado et. al. (2009) notes that “although underrepresented minorities are entering college interested in science at increased rates…their inclusion tends to represent token participation rather than meaningful incorporation” (193).

Cross-case analysis revealed that seven of the ten participants experienced some level of tokenism during their academic and professional careers. The exceptions, according to analysis of their interviews, were Keli‘i and Aloha. As the oldest of the participants their academic and professional experiences differed from the younger participants. Keli‘i, as mentioned previously, attended university during the Hawaiian renaissance of the 1970s.
At the time diversity in any field, let alone the sciences, was not emphasized to the degree it is today. Additionally, Native Hawaiians, particularly students, were beginning to take a more active role in musical, social, academic, professional, and political circles. Although Keliʻi spoke of challenges he faced as part of his community activism, he never once spoke of any type of tokenism. Aloha attended university and began his professional career as an engineer in the Continental U.S. roughly during this same period. According to him, the lack of awareness of Hawaiian culture and his light-skinned features helped him to avoid any kind of tokenism by his professors, friends, or employers. Aloha commented throughout his interviews that he was always treated with respect because he treated others with respect.

The younger participants, on the other hand, have each experienced some level of tokenism at the hands of their professors, degree program, and employers. Lawaiʻa succinctly expressed the sentiments of the other participants. “Sometimes people take advantage of the fact that I’m Native Hawaiian and they put me out there in kind of a dog and pony show. They point to me and say ‘this is our diversity. We have a Native Hawaiian graduate student.’” Kahelelani reinforced these feelings when she shared about her experience applying for an internship. “The director told me that I got the internship. He said, ‘the reason we’re doing this is 1) because you’re Hawaiian and 2) because you’re a woman.’ I’m thinking, ‘Oh, this isn’t based on my merit?’ I was the poster child. They wanted to utilize the fact that I was Hawaiian and female.” Along those lines, all of the female participants (Melemele, Hīhīmanu, Pōmaikaʻi, Kahelelani, and Hoku) spoke of the additional challenges they experienced as Native Hawaiian women in science-related fields. These included paternalistic and patronizing tones from male
peers, cultural assumptions, sexist language in manuals, classes, and labs, and even animosity from other female scientists and engineers. Their experience mirror findings noted by researchers such as AAUW (1998), Brickhouse, Lowery, and Schultz (2000), Brotman and Moore (2008), Carlone and Johnson (2007b), Chinn (1995, 2002), Malcom, Hall, and Brown (1975), and McKinley (2005a, 2008).

Focused coding revealed words such as disappointing, shitty, unsettling, sadness, and disrespectful when describing the feelings that resulted from these tokenism-related experiences. Kahelelani reinforced this point by explaining that she would feel devalued because she is not “just female or just Hawaiian. There’s more to me than that. It’s pretty important for people to see me as a whole person rather than by a single identity.” Malcom, Hall, and Brown (1975) noted that minorities in science “deplored tokenism and its destructive effect wherever it exists” (38). Further coding showed that while token experiences were troubling, they ultimately reinforced the participants’ passion to be their own person and not an assigned label or identity. Pōmaika‘i revealed during her interview that she has “been called the token Hawaiian, but that does not bother me because that is not all that I am.”

Analysis of thematic coding showed that these experiences reinforced the participants’ desire to be seen as scientists by Hawaiians and non-Hawaiians alike. The importance of this professional desire was conveyed by several of the participants. Lawai‘a explained that, “I’ve always felt that I wanted to be respected as a scientist, that I do good science, rather that I’m just Hawaiian. I want to be known as both.” “I don’t want to be accepted because I’m Hawaiian,” noted Kaipo. “I want to be accepted because I’m on the same caliber as everyone else” in the science classroom, laboratory,
and degree program. For the female participants, the added challenge of being female gave them extra encouragement to achieve their academic and professional goals. Coding also revealed that these experiences also encouraged participants to make a positive contribution to the field of science. As Hoku thought about the future of programs that support Hawaiian students, and her role in them, she noted that, “sometimes I feel like the poster child or a statistic that helps the college or organization look good. But that’s okay because I’m that statistic that could make a difference.”

Being a Native Hawaiian in science comes with many academic, social, and emotional challenges. “Poor achievement records in high school…conflicting obligations, false expectations, (and) poor preparation. First-generation students often stand at the edge of two cultures, that of their friends and family and that of their college” (Zalaquett 1999, 417). While Dennis, Phinney, and Chua
tco (2005) notes that “generalizations to other ethnic minority college student populations must be made with caution” (235), various support mechanisms have shown to be an important gauge of first-generation minority student success. Each of the participants acknowledged that the support they received throughout their academic and professional journeys made their successes possible.

Finding Support
The participants in this project have achieved success in science-related fields despite the aforementioned obstacles. Research has shown that individual motivation, parental support and involvement, and peer support are major factors determining the success of underrepresented minorities in science (Brotman and Moore 2008, Chinn 1995, Dennis, Phinney, and Chua
tco 2005, McCarron and Inkelas 2006, Phinney and Haas 2003). Open coding showed that each of the participants relied on various support systems
throughout their academic and professional careers as they navigated, merged, and transformed their cultural and professional identities.

Perhaps the most important source of support, as discussed previously, came from the participant’s families. Dennis, Phinney, and Chuateco (2005a), McCarron and Inkelas (2006a), Phinney, Dennis, and Osorio (2006), and Tseng (2004) have found that the motives that students have for attending college are influenced by the cultural values they obtained growing up. McCarron and Inkelas have even gone so far as to say “parental involvement was clearly the best predictor” (544) of success for first-generation students in college. Despite a lack of experience with higher education and professional fields, almost all of the participants spoke of the unconditional support they received from family members. Focused coding on this theme found many of the participants emphasizing the importance of parents “being there” and “being present” in their lives as a major supportive influence. “They were always there,” according to Hoku. “I never remember my parents not being at any function for us. They were always there no matter what. Between the two of them they were always there and that was huge.” Echoing these sentiments, Pōmaikaʻi mentioned that, “My parents and grandparents worked hard to ensure that our support network was intact and functional.” Whether it was hula practice, band, sports, or summer science camps, the influence and support of the participant’s parents and extended family cannot be understated.

Additionally, participants related how the cultural and religious values imparted by their parents and grandparents anchored and guided them through the challenges they faced. Pōmaikaʻi, for instance, spoke of how her family “taught me the importance of developing good relationships with others as trust is a key factor in human connections.”
This mirrors Aloha’s personal and professional philosophy to “be humble and to develop relationships” that he has carried with him since childhood.

Family, however, was not the only source of support for the participants. Open coding also revealed a great deal of support for the participants in the form of academic and professional advisors during and after college. This theme is especially poignant since, as cited previously, many of the participants experienced a lack of support prior to entering college. Analysis revealed that some mentor relationships were informal. For Kaipo, a family friend became a personal and academic mentor who helped guide him towards potential career pathways. One of Hoku’s doctors who cared for her during childhood illnesses later became her academic advisor during her residency. Analysis also showed that other mentors relationships were more formal and through academic or professional institutions.

Thematic coding on this topic showed that academic and emotional support gained from advisor/mentor has been invaluable to the participant’s careers. Lawai’a, Pōmaika‘i, and Hoku spoke of how their advisors were voices of reassurance when their heads were filled with self-doubt. Lawai’a derives strength from his advisor and committee who “are really supportive of me being Hawaiian doing scientific research and incorporating cultural aspects in to it” as he conducts his research. Embarrassed to be attending community college, both Hoku and Keala found great advisors that re-directed them to STEM fields. During that time Keala took “one science class that included geography, oceanography, and botany— all these different types of sciences put in to one class. I was just so absorbed in it!” According to him, the professors of that class really inspired him and helped him to recognize his interest in Hawaiian plants.
The positive impact of mentors was strong enough that many of the participants became advisors as they progressed through their academic and professional careers. Both Pōmaikaʻi and Hoku are now lead mentors in the same programs that supported them through graduate school and medical school respectively. Thinking about the impact his mentors have had on his life, Keliʻi spoke on how he thinks, “about those who have had a tremendous influence on my life and how I’ve been able to live up to the expectations they had of me. It’s not necessarily about me being a unique person or wanting to be my own star. It’s wanting to fulfill the expectations that they saw in me and…utilize all of those gifts and talents to the greatest extent possible.” Aloha also felt fortunate to have had great mentors. “I look back now and those…mentors and coaches and ended up as a who’s who of (my) field.”

In addition to department-specific academic advisors and mentors initial coding revealed a third major support network in the form of Native Hawaiian STEM cohorts. Research by Bonous-Hammarth (2000), Brotman and Moore (2008), Hurtado, Carter, and Spuler (1996), Monhardt (2000), Phinney, Dennis, and Osorio (2006), Smedley, Myers, and Harrell (1993), and Thompson and Bolin (2011) found that peer cohorts, particularly those made of students from similar racial, ethnic, cultural, and economic backgrounds, tend to be a rich source of support for first-generation college students. “Findings suggest that intervention programs,” such as STEM cohorts according to Smedley, Myers, and Harrell (1993), “are likely to be effective if they focus…on helping minority (students) to understand…the additional social and academic stresses they will face from their peers and from faculty in addition to providing academic support services” (449).
Further coding showed that those participating in STEM cohorts benefitted from them in a variety of ways. First and foremost, participants involved in these groups realized that they were not as alone as previously imagined. This, according to several participants, reduced the anxiety they had about being one of few Native Hawaiians in science. Keala, who is actively involved in such a program as an undergraduate student, feels “a lot of pressure from program mentors because… they didn’t have as many opportunities as Native Hawaiians now. When they see students with potential, they don’t want us to stop. They want us to keep going and they want us to be the best.”

Along with an emphasis on guidance and peer support, Native Hawaiian STEM programs have also provided participants with financial resources, scholarships, grants, and paid research and internship opportunities so they could realize their academic and professional goals. For Pōmaikaʻi, “It was the building of an academic community which included mentoring, reinforcing of cultural values (i.e., respecting, working with and appreciating others), service learning projects with a cultural relevance (i.e., restoration work on Native Hawaiian fishpond and ahupuaʻa as well as on the island of Kahoʻolawe)” that also drew her to such a group. Hīhīmanu and Hoku agreed that community involvement and cultural reinforcement are keys to such programs in addition to academy support.

For Pōmaikaʻi, Hoku, and Keala, their participation in Native Hawaiian STEM programs was purposeful. Each credits much of their success in college and, in Pōmaikaʻi and Hoku’s cases beyond, to participation in such programs. Hīhīmanu and Melemele became involved in these kinds of programs almost by accident, while Kaipo’s participation as a graduate student has been minimal. For Melemele, her involvement
started by applying for a scholarship. “I didn’t plan to be in the STEM program. I didn’t say I’m going to go to school and do a science degree. I just wanted to learn about plants.” Hīhīmanu said that, “They actually found me in high school. I applied to the university and I got a letter in the mail along with my acceptance letter saying, ‘We identified that you are Native Hawaiian’” and she was invited to work with other Hawaiian and Pacific Islander students over the summer prior to her freshmen year. Both Aloha and Keliʻi, who were not able to participate in such programs, welcome this kind of targeting. “We have all these Hawaiian companies and you’ve got graduates from Kamehameha Schools…creating programs to engage them to provide students with scholarships and internship opportunities. I can see that happening now.”

**Research Questions Revisited**

This case study explored the lived experiences of identity construction and negotiation of ten (10) Native Hawaiian members of Hawaiʻi’s STEM community. The purpose of this research project was to explore the complexities of identity development to explore the relationships between intersecting, and potentially contrasting/supporting, identities. To conclude this chapter, it is necessary to revisit the research questions listed on page 4 in Chapter 1 of this dissertation and to briefly address each of them based on the findings of this project.

**What is the lived experience of identity construction and negotiation when multiple identities (Hawaiian and Scientist) are considered?**

The concept of identity salience—one “role” being more or most prominent at a given time—was a major theme examined through this project. Literature in connection with Indigenous and professional, particularly science-related professional identity, dimensions of identity tend to focus on the ways in which these two dimensions conflict with each other. Within this paradigm, Indigenous individuals in the sciences must either
explore scientific fields that easily connect with their traditional culture and cultural identity or ignore certain aspects of their indigeneity in order to adopt a science or scientist identity. Coding of the individuals in this project revealed that the salience of their personal and professional dimensions of identity shifted, overlapped, merged, and sometimes conflicted. However, the participants all noted that while the level of importance of a dimension of identity may change at any given moment, the overall importance of that dimension of identity does not change.

Many of the participants see things through both Hawaiian and scientist lenses. Their Hawaiian lens enables them to use the values that were instilled in them at a young age to guide their decisions personally, culturally, and professionally. The scientist lens not only gives the participants a pathway to a degree field and career they enjoy but also a method of analyzing the world around them and tools to better their community. The interaction of these lenses is complex. However, each of the participants have found ways to utilize them to maximize both their cultural and professional identities.

The acceptance of the salience of two or more identities mirrors paradigm shifts recommended by Appiah (2006), Sen (2006) and Solomon (2012) and researched by Abes and Jones (2004), Abes, Jones, and McEwen (2007), and Stewart (2008, 2009). It also contains aspects of both identity theory (Hoelter 1983; Stryker 2000) as well as social identity theory (Cornelissen 2007; Haslam et. al. 1999; Whetten 2002). The participants’ conceptualization of their own identities, especially when multiple identities are considered, is more complex than any semi-rigid hierarchy espoused by symbolic interactionism, identity theory, and social identity theory. Participants stressed that their personal and professional identities were equal but in different ways and suggests
processes that are extremely fluid and dynamic with saliences occurring singularly and/or simultaneously. The level of salience for one dimension of their overall identity or the interaction of multiple saliences is based on internal cognitive processes developed during life-shaping childhood experiences and reinforced socially, culturally, and psychologically throughout the participants’ lives.

**How is/are identities experienced and constructed?**

Many of the participants admitted that there have been challenges in accepting both their Hawaiian and scientist identities. They each trace the source of salience for both Hawaiian and scientist identities family support, place-based opportunities, and situations that reinforced their identities. Family support and encouragement, for many of the participants, made the biggest impact in the development and maintenance of both Hawaiian and scientist dimensions of identity. Positive cultural interactions with family members resulted in higher rates of Hawaiian identity salience. Family trips to the beach, luaus, food, learning about the ocean, tides, and Hawaiian names of plants and animals from kūpuna were all examples of experiences cited by participants as having a long-lasting impact on their cultural identity. All of the participants consider family to be a core Hawaiian value, which continues to influence and guide them. In addition to family and community influences, coding revealed that geography as an important factor in the development of the participants’ Hawaiian identity. Consistent access to cultural reminders such as food and language of Hawaiian culture, people, cultural sites (lo‘i, fishponds, and heiau), and natural aspects of the land (mountains, ocean, plants, and animals) influenced the Hawaiian dimension of the participant’s identity.

Just as the salience of the participants’ Hawaiian identity formed through the life experiences, the salience of the scientist dimension of identity for each participant
developed through similar means. For many participants, their interest and aptitude for science started in childhood. Parental and family support for early interest was just as critical to the establishment of the participants’ scientist identities. Education was a priority with many of the narrator’s parents sending them to private schools, afterschool programs, and encouraging and engaging them in other life-shaping activities. These took the form of mentoring relationships, summer camps, extra courses in school, and extra-curricular science activities, scholarships, and internships. Additionally, each of the ten individuals in this project could point to key experiences that aided in the establishment of the scientist identities such as lessons from family members and childhood diseases.

While acknowledging differences between so-called “Western” science and Hawaiian culture, the participants critiqued the separation of what is commonly called “science” from local values, narratives, and place-based knowledge. Lawai’a observed how “all of my experiences shape who I am…because all those experiences, positive and negative, synergistically created who I am today.”

**What are the sociocultural/historical/political contexts that influence and shape identity?**

Smith (2004) remarks that one of the two frameworks that shape and develop Indigenous culture is imperialism. She explains that imperialism and colonialism are “part of our story, our version of modernity” (19). Just about all the participants acknowledged and spoke on how, until relatively recently, being Hawaiian was considered a bad thing. Younger participants recognize the struggles that their parents and grandparents had to suffer. Many of the participants feel enormous pride in being Hawaiian but also acknowledge that as Hawaiians they must look forward to the future
rather than focusing on the past. The participants aim to look beyond some of the current anger and frustration currently expressed by some members of the Hawaiian community. They not only see their success in science as a way to help themselves, they see it as a way to help their community socially, psychologically, and financially. Cultures that have experienced both physical and existential trauma seek to recapture what was lost while acknowledging the need to move forward. This can often cause friction within the community as it seeks to find balance between pre-contact values and the demands of modern society membership.

Coding revealed that at the heart of the intersection and interaction between Hawaiian and scientist identities is the question of what it means to be Hawaiian. Cultural and spiritual connections between traditional Hawaiian culture and modern science were highlighted by the participants and mirrors research such as Ah Sam and Robinson (1998), Aikenhead (2001a), Chinn (1995, 2008), and Maaka (2005). Participants in this project see similarities between indigenous and scientific knowledge systems but also acknowledge some differences. Rather than assuming that these differences are insurmountable the participants work personally and professionally to be bridges between Hawaiian and scientist identities and cultures. Each of the participants noted that there are members of the Hawaiian community who may not appreciate their love of science leading to continuous self-reflection on the part of the narrators. Participants have responded to these challenges by asking, “what are Hawaiian things?”

Fortunately for the participants, there are historical precedents to support Native Hawaiian interest in science. All of the participants noted that ancient Hawaiians were very skilled in what is now called the sciences. This includes agriculture, astronomy,
navigation, engineering, and the classification of living things. Additionally, King Kalākaua, who is celebrated for his efforts to reinstitute and reengage Hawaiians in aspects of traditional Hawaiian culture, also founded the Hale Nauā society. Participants spoke of King Kalākaua’s desire to see Hawaiians at the forefront of any and all scientific fields, to be competitive with the rest of the world, and the need for Native Hawaiians to pursue science degrees and careers and a way to fulfill that desire.

Focused coding revealed how the participants felt their scientist identity reinforced their Hawaiian identity and vice versa. Keeping historical context in mind, the participants focus on how they, as scientists, and the science they do affect their community. Several participants stressed that scientific content and knowledge is important but that one of their primary motivations is the impact the knowledge will on the community. The pride they have as Hawaiians in science also comes from how they approach the scientific field they have come to love, the scientific research and professional work they do, and how they approach and work with colleagues.

**What are the personal, social, and professional contexts that influence identity salience?**

Both family and community have an effect of the salience of the scientist and Hawaiian dimensions of the participants’ identities. The support, encouragement, and challenges received from their close family made a lasting impact on the participants’ scientist and Hawaiian dimensions of identity. Further analysis, however, revealed that the salience of particular dimensions of the participants’ identities was also driven by geographic/ecological proximity and influenced by social and professional situations. These factors mirror scholarly research such as Abes and Jones (2004), Denzin, Lincoln,

Almost all of the participants admitted that living in Hawai‘i makes their Hawaiian identity more salient. Geographic access to the food, language, people, and sites important to Hawaiian culture such as lo‘i, fishponds, and heiau makes the salient the participants’ Hawaiian identity on a regular, if not daily, basis. Ecological reminders of Hawaiian culture such as the land, mountains, ocean, plants, and animals, which have cultural importance and symbolism also make salient the Hawaiian dimension of identity. Geographic and ecological drivers of identity salience became most evident, according to the participants, when they each came in contact with Hawaiians who were either born and raised in the Continental United States or had moved to the Continental U.S. early in their lives. Due to the lack of consistent cultural reminders, these individuals had little to no knowledge of their Hawaiian culture and the values important to Hawaiians living in Hawai‘i.

The geographic impact of living in Hawai‘i extends beyond the salience of Hawaiian identity and also affects the salience of the participant’s scientist identity. Participants noted that being in Hawai‘i impacts their choice of research projects and careers. In some cases, this includes the merging of local, cultural, and scientific knowledges as part of research projects and graduate studies—a task that would be more difficult outside of Hawai‘i. Some participants chose to attend university in Hawai‘i to remain close to family despite the advice from mentors to pursue graduate degrees at other universities because “it looks better on your CV.” Most importantly ecological/geographic drivers of
identity salience has guided many participants in how they do science, where they do science, and the kind of scientists they have become.

The narrators of this project also stressed that the management of the salience of their identities is situational and influenced by externally generated factors just as much as it is internal. For example, while their Hawaiian identity is a core identity that both anchors and guides them on a day-to-day basis, the degree of Hawaiian-ness they openly display depends greatly on who the participants are speaking with, where the situation occurs, the circumstances of the encounter, as well as the expectations of the people around them. At scientific conferences, for example, the participant’s scientist identity may become slightly more salient as opposed to their Hawaiian identity. However, as one of few Hawaiians in science the participants’ Hawaiian identities can also become very salient as they become de facto cultural ambassadors for a typically non-Hawaiian audience. Although the participants may make their Hawaiian-ness known they expressed hesitation in openly sharing cultural practices and information. Situational salience of this type requires the participants to become “cultural chameleons,” a phrase that came up several times during interviews.

The participant’s dimensions of identity are variously experienced, in some cases, individually but more often experienced at different salience levels simultaneously. These intersections and interactions demonstrate that no one dimension of identity may be completely understood singularly. Instead, single identities can be understood better in relation to other identities and the factors that influence their salience.
CHAPTER 5. DISCUSSION AND IMPLICATIONS

“We all change. When you think about it, we’re all different people, all through our lives and that’s okay. That’s good. You’ve got to keep moving, so long as you remember all the people you used to be.” – The Doctor (Moffat 2013)

Discussion
The idea of pluralistic identities has become a rich source of research endeavors in the fields of psychology, sociology, anthropology, and education. In addition, individuals in many different public arenas demand acknowledgement and recognition of their multiple and unique identities and the worldviews that accompany them. In recognition of this demand for a pluralistic approach to identity, researchers in this area of study are reconceptualizing models of identity to incorporate multiple dimensions of conceptions of the self. Researchers are recognizing what all ten of the participants in this project already know—that identity development is a process and that multiple facets of identity interact, intersect, support, and impinge upon each other. The models of multiple dimensions of identity shown in Chapter 2 are attempts to show how real life experiences create identities that do not fit neatly into the compartmentalized boundaries preferred by statisticians, researchers, and analysts.

We All Have Multiple Identities
This research project went beyond the reaffirmation that we all have multiple identities. This was done in two ways. First, I offered a comparison of scholarly literature based on singular and multiple identity models and those reconceptualizing multiple dimensions of identity. Secondly, I interviewed ten individuals who are Native Hawaiian scientists and who provided their personal perspectives about their experiences in the construction of their identities and in the interactions between their Hawaiian and scientist identities. The interviews gave me a better understanding of the reality that these individuals face while navigating their Hawaiian and science identities.
Unfortunately, attitudes arising from the singular identity model are prevalent in the scholarly literature, curriculum design, and student support systems. The singularist model assumes that people have one predominant identity that is often used as a means to a) distinguish and separate them from others and/or b) place individuals into groups based on this single identity. In this paradigm, the intricacies of what makes an individual unique and the concept of plural identities, as expressed by all ten participants, “are obliterated by seeing each person as firmly embedded in exactly one affiliation” (Sen 2006, 20) be it either as a Hawaiian or as a scientist. More importantly, the singular identity paradigm in this case is used to limit the potential an individual has in either expressing themselves culturally or pursuing interests that lead to degrees and careers in science, technology, engineering, and math. Both are unfortunate and unfair.

In the past, efforts to improve the quality of education for the majority of Native Hawaiian youth has been hampered by identity disregard—the “ignoring, or neglecting altogether, the influence of any sense of identity with others, on what we value and how we behave” (Sen 2006, 20) This, unfortunately, continues to be the case in scientistic, multiculturalist, and infusionist literature. Despite the best of intentions, scholars have been caught in a singular affiliation framework “which takes the form of assuming that any person preeminently belongs, for all practical purposes, to one collectivity only” (ibid).

Intersectionality models of identity (Abes, Jones, and McEwen 2007, Jones and McEwen 2000) present a more nuanced view of an individual’s identity reality than hierarchical models. Deleuze’s ontology, in which difference rather than similarity, is the fundamental building block of identity is also preferable to hierarchical models.
However, post-modern research and the reconceptualized intersectionality models of identity have, in my opinion, two major flaws. The first is that while identity orbital paths intersect and presumably interact with each other, there is no representation of the long-term merging of identities described by the participants nor do such models allow for continuous changes and states of “becoming” (Deleuze 1994, Deleuze and Guattari 1987) that occur throughout our lives. Therefore, despite the possibility of interaction and intersection, such identities remain separate. Secondly, the description and representation of identities in these models presumes unity within identity categories. In this study, internal differences of identity groups became clear through participant interviews. While each claim the “Hawaiian” and “scientist” identities, the purpose, importance, reasoning, and meaning behind those claims is unique to the individual.

**Hybrids, Borderlands, and Threshold People**

The non-contrasting identity attitude that the participants have regarding the interaction and intersection of their cultural and professional identities runs counter to the single identity affiliation paradigm. While the salience levels of these dimensions of their identity change, they are comfortable existing as both at the same time. This long-term merging of identities, as well as the identity differences each participant represents, demonstrates limitations in intersectionality models as well. Lawai’a, Keala, Melemele, Pōmaika‘i, Keli‘i, Hīhīmanu, Kaheelelani, Hoku, Kaipo, and Aloha are *threshold people* (Anzaldúa 2002, Keating 2006). Threshold people exist at the intersection and interaction of identities instead of choosing to make a beautiful life in one world or another. “They move within and among multiple…worlds and refuse to align themselves exclusively with any single individual, group, or belief system” (Keating 2006, 6).
This idea is supported by comments made by the participants themselves. For example, during his interviews Lawai‘a noted excitedly that perhaps a new (Hawaiian-Scientist) identity and paradigm was emerging as more Hawaiians chose to pursue science degrees and careers. This hybrid identity existing at the border between Hawaiian and science identities places all ten participants in a unique position as members of both communities (Grenfell 1998, Hall 2009, Ledward 2007, McKinley 2008) and should be supported. On the one hand, as members of the Hawaiian community they have the potential to be role models for generations of Hawaiian students interested in science. They are Hawaiians who have been successful in high school, college, and beyond in fields that can both support Hawaiian culture and challenge what it means to be Hawaiian. On the other hand, as members of the science community each of the participants can be much more than a token presence in a department. They have the potential to affect real change within the scientific community and to show that indigenous and scientific methodologies can work hand-in-hand.

Almost all of the participants noted the importance of playing a role as an intermediary, because being a link between the Hawaiian and science communities was an influential factor in their academic and professional decisions. As scientists of Native Hawaiian ancestry, all of the participants are resisting rigid labels and developing new identity alliances. They are making the bridges between worlds their home. Both Keating and the participants in this project note that adopting a role that spans multiple worlds is a difficult one.
Risk Vs. Reward

The risk of being harmed by “isolation, misunderstanding, rejection, and accusations of disloyalty” (Keating 2006, 6) and of having one’s sense of identity disputed, attacked, or impeded was raised by almost all of the participants. Both Melemele and Keala, for instance, specifically noted the lack of academic support from his family. Many of the participants also spoke of how their studies in science challenge the socioeconomic status quo—Hawaiians have to be the “rubbish man” or “have jobs that require physical labor.” Jon Osorio’s aptly titled article What Kine Hawaiian Are You? (2001) is appropriate for the participants in that they have faced that very question for choosing to pursue degrees and careers in science. While individuals bridge different identities there must also be acknowledgement of the difference between individuals that claim the same identity. From identity challenges explored in this project, however, came strength, perseverance, and the development of “potentially transformative perspectives (that) respect the differences within and among diverse groups and simultaneously posit commonalities” (Keating 2006, 6).

All ten individuals in this project share two particular identities, those of being Hawaiian and a scientist. However, the paths that led each participant to recognize and embrace these particular identities are different. The participants recognize that their experiences and tools can create opportunities for organizations interested in embracing difference. Additionally, these same experiences have the potential to help future Native Hawaiian students enrolled in STEM majors both here in Hawai‘i and elsewhere in the world. Support for Native Hawaiian students interested in STEM-related fields is absolutely essential. Several participants in this research project are members of cohorts
and clubs with missions to support Native Hawaiian and other underrepresented groups in the sciences.

**Implications**

As I conclude this dissertation, I would like focus on two main implications of this research as well as five recommendations for further research in this area. The first implication has to do with a consistent theme throughout this research project and dissertation—embracing the plurality of identity. Along those lines, the second implication is that the research supports a shift to a different identity paradigm, one that offers greater inclusion and acceptance. This paradigmatic shift will enable both secondary and post-secondary institutions to create more effective methods of academic, emotional, psychological, and cultural support for Native Hawaiian STEM students.

**Embracing Your Hybridity**

Embracing and accepting difference within identity groups is difficult. The very notion of creating a name or a title for particular identities creates the illusion of uniformity when, in fact, none may exist. We accept that some things change. “In a context of constant change, the learning and teaching of natural science and technology cannot operate as if knowledge” (van Wyk 2002, 305) stands still. At the same time, “individuals participate in the process of culture and tradition, but also in ways that may exceed the culturally given or expected” (ibid). Fully acknowledging what is definitive, ambiguous, potentially paradoxical, and uncertain about our overall identity is part of the process of accepting the ways in which different dimensions of identity intersect and interact.

Just because two people are Hawaiian does not mean that they have had the same “Hawaiian experience.” Just because two women are scientists does not mean the paths
they took to embrace their love of science are at all similar. The shared experiences of Lawai’a, Keala, Melemele, Pōmaika‘i, Keli‘i, Hīhīmanu, Kahelelani, Hoku, Kaipo, and Aloha taught us that there are many paths in the construction of an identity and that seemingly oppositional identities can be effectively navigated and integrated. This project only speaks to the experiences of the individuals involved. However, the fact that all of the participants have found ways of balancing both their cultural and professional identities is useful to those looking to be more inclusive and accepting of other points of view and to provide support for underrepresented students in STEM majors.

All Knowledge Is Not Taught In the Same School

Very recently I had a discussion with a science faculty member at the University of Hawai‘i regarding Native Hawaiians in STEM-related fields. She lamented the difficulty their department was having in hiring Native Hawaiians and other people of color because their department was “too white.” She wanted to know if there was anything in this project that might help them. In response to their inquiry, I commented on the merging of Hawaiian and scientific methodologies. I also mentioned how adamant the participants were about doing research that would benefit the local community instead of doing research for publication and presentation at a conference. After a careful pause, they responded by saying, “Hmmm, that’s interesting. I never would have thought of that.”

Reflecting on this discussion led me to question exactly why this individual and her department wanted to hire Native Hawaiian scientists. Is it because they are looking for individuals who can bring new perspectives, tools, and methodologies to the research that is being conducted? Or is it because they want to appear diverse and have an individual of Native Hawaiian ancestry to point to as an example of this “diversity?” I hope it is the
former but I feel that it was the latter. Taum (2010) notes that, “despite the rhetoric, Hawaiian culture has continued to be treated as a ‘value added’—like condiments rather than the entrée. The time has come to elevate culture to a more prominent place on the menu of offerings, and in doing so strengthen the product, its identity, and the Hawaiian ‘sense of place’ that makes our island home the unique place that it is” (37). If the science community is genuinely interested in increasing the number of women and minorities in science fields, the community must recognize what these individuals can bring to the discussion. Saying that you want to hire Hawaiian scientists while expressing little or no interest in Hawaiian epistemology/methodology will not foster trust between the Hawaiian and science communities and will not get Hawaiian students excited about science.

At the same time, several of the participants felt that there is pressure by members of the Hawaiian community to pursue certain types of science. There is particular pressure to study life, earth, and certain aspects of space science. Several participants commented on the way cultural-specific curriculum is too limiting. Pomaika’i in particular commented that her program always did a taro project with incoming freshmen. Why not do a molecular biology project? Why not do a deep space observation project? Why not do a chemical engineering project? Additionally, participants questioned why university departments that focus on Hawaiian culture and language are not encouraging students to pursue dual degrees. While many of the participants find value in studying Hawaiian culture and language, they also commented on the need to be an ambassador of Hawaiian culture in careers outside of Hawaiian studies.
Creating a Support Network

The lack of genuine interest shown by science departments for the experiences and well-being of underrepresented students is cited as a reason for the stagnation in the number of women and minorities pursuing graduate degrees and careers in academia despite increases in those groups pursuing undergraduate degrees (AAUW 1998, National Science Foundation 2013). As one of the few “brown faces” in the science classroom and labs, the participants occasionally felt alone and isolated. Compared with their Caucasian peers, Indigenous students experience greater amounts of difficulty adjusting to the social, psychological, and academic rigors of academia (Brotman and Moore 2008, Johnson 2007, National Science Foundation 2013, Wendland 2007) leading to feelings of isolation. Supporting students as they navigate and reconcile their Hawaiian and scientist identities has fallen to supportive programs aimed at alleviating the isolation underrepresented students, particularly Indigenous students, feel upon entering the university community. Seven of the ten participants in this project have been involved, at one time or another, with programs and cohorts that work exclusively with Native Hawaiians in STEM-related degree fields. Support programs in New Zealand, Alaska, and Hawai‘i seek to reverse Indigenous student isolation by providing peer support groups, academic advisory support, peer and industry mentors, homework help, scholarships, and internship opportunities.

The University of Auckland’s Tuākana Programme, for example, has been supporting Māori students for over twenty years. Noticing that passing rates for Maori and Pacific students have been much lower in the past, the science Tuākana program provides “tutorial support, course information, exam workshops, opportunities to connect with potential employers, and an established cohort of students and staff to walk alongside”
students as they achieve their goals. Professor Michael Walker, one of the founders of the program, noted dramatic increases in passing rates (from 40 to 60 percent), percent representation in all undergraduate Stage III Biology papers (from 4 to 8 percent), and numbers of scholarships and entrance to professional schools for Māori students after the establishment of peer tutorials in 1991. Tuākana is based on the concept of older siblings (Tuākana) supporting younger ones and helps students transition to university life and achieve academic success (Tuākana 2013).

The Alaska Native Science and Engineering Program (ANSEP) is similar to Tuākana in that it supports Native Alaskan/First Nation students pursuing college degrees. With a greater emphasis on pre-college and career support, ANSEP began in 1997 with a cohort of approximately 125 students. In the fall of 2012, approximately 500 students were taking part in ANSEP related programs at the University of Alaska with over 250 students (cumulative) receiving STEM degrees (ANSEP 2013).

Similarly at the University of Hawai‘i at Mānoa a joint initiative in 2001 between the College of Engineering and Kamakakuokalai Center for Hawaiian Studies led to the creation of the Native Hawaiian Science & Engineering Mentorship Program (NHSEMP). Based on ANSEP, NHSEMP started with a cohort of fourteen students. It has since “grown to become a national model for science and engineering higher education bridging educational institutions” (NHSEMP 2013). In the fall of 2013, over ninety science and engineering students ranging from freshmen to PhD students in fields such as Biology, Botany, Engineering (civil, environmental, electrical, and mechanical), Natural Resources & Environmental Management, Mathematics, Molecular Biosciences and Bioengineering, and Zoology were participating in the program.
The challenge, as some have expressed it, is that such support programs often stand apart from specific campus departments and are tied to the availability of funding.

Tuākana is a university-wide program with Tuākana advisors integrated into the faculty of arts, business, creative arts and industries, education, engineering, law, medical and health sciences, and science. Being fully integrated makes funding more stable and the program more sustainable in the long run. ANSEP’s financial partners include energy companies, which also provide internship and career opportunities, energy and natural resource-related government agencies. NHSEMP, on the other hand, relies almost exclusively on grant funding. While it receives some legislative support, it receives no funding from the university departments that support it. The time spent searching for grants (soft money) takes time away from supporting students and makes future planning difficult. Most importantly, if funding runs out, the cohort could cease to exist and students can be left without the supports necessary for success.

The participants in this project are bridging the cultural gap between science and Hawaiian culture. However, if there is going to be real progress in making science more accessible to Hawaiian students there will need to be a paradigm shift on three fronts. First, university science departments, particularly in Hawai‘i, need to examine the research in which they engage to determine the value it has to the local community. Secondly, members of, and those who work with, the Hawaiian community also need to evaluate whether the curriculum and programs geared towards Hawaiian students in science is encouraging all students or only a certain segment of population. Lastly, the State of Hawai‘i lacks the corporate infrastructure, financial foundation, and support that make ANSEP more sustainable. Instead, the University of Hawai‘i should look to
Tuākana as a model. A Hānau mua\textsuperscript{71} support system integrated across a university campus and system and into each college would provide effective long-term support for all Native Hawaiian students, particularly those in STEM-related degree fields. Such integration would send a powerful signal to the Hawaiian community that colleges of science and engineering take the needs of Hawaiian students seriously. Additionally, with a dedicated staff Hānau mua faculty member, each college can provide support and guidance specific to the needs of particular degree fields and the students enrolled in them.

Addressing the questions and concerns raised by the participants in terms of the intersection of Hawaiian and scientist identities will not be easy. Further research, however, will help to begin discussion and shed light on those individuals who are making their lives on identity bridges as threshold people.

**Recommendations for Further Research**

Having conducted, reviewed, and discovered several important themes linking Lawai’a, Keala, Melemele, Pōmaika’i, Keli’i, Hīhīmanu, Kahelelani, Hoku, Kaipo, and Aloha there are several additional areas I would recommend exploring. First, as a non-Hawaiian, there were some insider-outsider issues that were inherent during the development and execution of this project. I worked very hard to establish a rapport with all of the participants prior to beginning the actual interviews. While I was able to find areas of commonality and connection with all of the narrators, there may have been certain cultural avenues that I could not access whereas a primary investigator of Native Hawaiian ancestry might. I would be very interested to see a research project similar to this in scope and topic done from a Hawaiian perspective. Such a project would provide scientists, educators, and counselors with valuable insight. Additionally, both this and
another similar project could be compared and contrasted as a way to explore the role and perspective of indigenous and non-indigenous researchers in Indigenous research.

Secondly, many of the narrators spoke of how being born, raised, and currently living in Hawai‘i affected the salience of their cultural identity. This was due to access to both physical and existential symbols of Hawaiian culture on an almost daily basis. Even more, they spoke of friends and family members of Hawaiian ancestry missing a portion of their “Hawaiian identity” because of living in the continental United States. Further research with a focus on ecologically driven identity salience and the effects of cultural proximity should be conducted. Interviews with more individuals of Hawaiian ancestry in Hawai‘i and beyond will provide insight on the development and maintenance of Hawaiian identity.

Thirdly, although half of the participants in this project were women, a thorough gender analysis of Native Hawaiians in science, technology, engineering, and math (STEM) is lacking. Such an analysis would provide insight into the challenges that minority women face in the sciences and could be invaluable to colleges of science and/or education, as well as other organizations whose mission it is to encourage minorities to go into the sciences. All ten of the participants in this project could be thought of as a minority of a minority in that they are Hawaiians involved in STEM-based programs/professions—a small professional community within an already relatively small ethnic community. The women of the group - Melemele, Pomaika‘i, Hihimanu, Kahelelani, and Hoku—have provided additional insight into the reality of being a minority of a minority based on their professional, ethnic, and gender identities. Part of the constructivist/postmodern framework is the
acknowledgement that reality is different for each individual based on a plethora of dimensions. Therefore, we must acknowledge that while there are some similar ethnic experiences between the male and female narrators in this project, the realities of the female members differ from their male counterparts and indeed from each other. These realities are worth exploring.

Four of the members of this participant group (Hihimanu, Hoku, Kaipo, and Aloha) attended and graduated from Kamehameha Schools – a prestigious private school in Hawai‘i for Hawaiian students. Their experiences varied widely. Each is appreciative of the opportunities afforded to them, but they also raise some concerns. These include, but may not be limited to, the intensity of the educational experience at Kamehameha Schools, the social/socializing aspect of students and its impact on self-esteem, the emotional impact of Kamehameha Schools for those in the broader Hawaiian community, and the apparent preference to support highly motivated students. Kamehameha Schools does a lot of good for its students and for the wider community. However the realities of the experiences of these four participants, and other students with similar experiences, cannot and should not be ignored. As such, an in-depth, longitudinal, qualitative study with graduates from Kamehameha Schools would provide insight into the individual and collective experiences of students afforded the opportunity to attend this prestigious institution.

Several participants noted that their passion for science was begun and fostered outside of the classroom. Although not cited directly by any of the participants, I believe that informal extracurricular programs like Science Olympiad, Science Fair, and Robotics can also support Native Hawaiian students interested in STEM-related fields. For
example, research by Baird, Perry, and Simon (1989), Baird, Shaw, and McLarty (1996), Cairns (1984), Hounsell (2001), Putz and Wirt (2012), and Wirt (2011) has shown that
the hands-on, problem- and team-based nature of Science Olympiad is an attractive
supplement to students who may not find success in the classroom. Research with Native
Hawaiian middle and high school students participating in extra-curricular STEM-based
programs could provide insight into their motivations to explore the world of science as
well as the benefits they derive from their participation in such programs.

Lastly, a considerable amount of time was devoted to interviews and discussion on
the interaction of Hawaiian and scientific methodologies and epistemologies from an
insider perspective. Meaning, all of the opinions expressed were by individuals of
Hawaiian ancestry who have chosen to be involved in science, technology, engineering,
and math. While the individuals in this project have found beautiful and productive lives
in science, they also admitted there are larger societal challenges in connecting the
science and Hawaiian communities. Future studies involving Hawaiian (and other
Indigenous) and scientific methodologies and epistemologies would be a valuable to
learn more about the perspective of science from the Hawaiian community.

**Conclusions**

Scholarly works on indigenous peoples and science education separate the two
identities (scientist and Hawaiian). Intersectional models of identity attempt to join the
two together but do not take into account the ability of the individual to exist at the
intersection itself. The reality is much more complicated. The participants themselves
view their Hawaiian and scientist identities as two of many parts that make them whole.
While the salience of each identity changes over time and through experiences, many of
the participants view themselves as bridges between the two. Lawai’a, Keala, Melemele,
Pōmaika‘i, Keli‘i, Hīhīmanu, Kahelelani, Hoku, Kaipo, and Aloha see themselves as both Hawaiian and scientists existing at the same time with shifts in emphasis and degrees of importance. Navigation between the two has been turbulent for some of them at times. But the steps they have taken throughout their lives has allowed them to develop a pluralistic view of themselves.

Each refuses to be compartmentalized and categorized as solely Hawaiian or a scientist. In addition, they refuse to see the particular identities as mutually exclusive. The narrators of the project represent a new combined Hawaiian/scientist identity. One in which Hawaiians are not forced to give up part(s) of their indigeneity, nor are they limited to exploring scientific venues that can be easily connected to “Hawaiian things.” Instead, it will be an identity guided by a plurality of methodologies and epistemologies that take the best of both world and, as a result, becomes stronger and more versatile.
APPENDICES

Appendix A: Semi-Structured Interview Protocol

Quantitative Interview Protocol

Participant Demographical Information
  a. Age
  b. Current residence
  c. Highest Level of Education Attained
  d. Education institution(s) attended
  e. Occupation
  f. Status in Scientific Community (i.e. student, professional, retired, etc.)

Participant Professional Information
  a. How long have you been a science teacher?
  b. What type of science do you specialize in?
  c. Are you involved in any science organizations?
  d. Are you / were you involved in any education organizations?
  e. Are you / were you involved in any Native Hawaiian organizations?
  f. Are you / were you involved in any Science and/or Native Hawaiian education initiatives?
  g. Do you (or did you?) identify yourself as a Native Hawaiian?

Qualitative Interview Protocol
(Adopted and adapted from Seidman (2006) and Stewart (2008, 2009))

Interview One: Life History
  A. What is your family like (parents, step-parents, siblings, extended family)?
  B. What are you most memorable familiar experiences; positive and negative?
  C. Where are you from? (Follow ups included: How did you feel about growing up there?)
  D. Where did you go to school (elementary, secondary, college)?
  E. What are your most memorable educational experiences, positive and negative?

Interview Two: Social/Cultural/Professional Identities
  A. How did your experiences guide you to your current profession?
  B. How would you answer the question, “Who am I?” (Other versions of this question may be used depending on participant background and may be asked several times)
  C. What image would you use to describe how you see parts of your identity?
  D. How did you come to see yourself this way?
  E. Have you always felt this way? How has your understanding of yourself changed over time?
  F. Have you ever felt conflict in your identity(ies), as you have described it, while growing up? While going to school? In your professional life?
  G. Have you been able to weave these identities together somehow?
     i. Do you want to weave them together?
     ii. Do you think/feel that you should?
  H. Have you been able to navigate between these identities somehow?
     i. Do you want to weave them together?
     ii. Do you think/feel that you should?
  I. What does it mean to be a Hawaiian man/woman?
i. Has that ever conflicted with how other people think you should act/feel/think as a Hawaiian man/woman?

ii. Has that ever conflicted with how other people think you should act/feel/think as a scientist/science teacher?

J. Do you feel any sense of ownership over your racial/ethnic/professional identity?
   i. Have you ever felt or do you feel like someone else has ownership over your racial/ethnic/professional identity?

**Interview Three: Making Sense of it All**

a. How is your experience being a Native Hawaiian scientist/science teacher different from what you suppose your experience would be if you were a non-Hawaiian scientist/science teacher?

b. How has your education, however you define that, changed you as a person?

c. How has your education changed your definition of what means to be Native Hawaiian and a scientist/science teacher, if it has at all?

d. How important is it for you to be whole? Why or why not?

e. What do you depend on when it feels like your world is falling apart?

f. If you could remake yourself in any way, what would you change, if anything?

g. Are there any other comments you would like to add?
Appendix B: IRB Exempt Letter

UNIVERSITY OF HAWAI‘I
Committee on Human Studies

September 7, 2011

TO: Franklin S. Allaire
    Principal Investigator
    Educational Foundations

FROM: Nancy R. King
      Director

Re: CHS #19462- “A Case Study on Ethnic/Cultural and Professional Identity Salience with Native Hawaiian Members of Hawaii’s Science Community”

This letter is your record of CHS approval of this study as exempt.

On September 7, 2011, the University of Hawaii’s (UH) Committee on Human Studies (CHS) approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46 (2).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html.

Exempt studies do not require regular continuing review by the Committee on Human Studies. However, if you propose to modify your study, you must receive approval from CHS prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) CHS may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify CHS when your study is complete. Upon notification, we will close out your files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact CHS at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.
Appendix C: IRB Approved Release Form for Scholarly Research

(Based on recommendations by the University of Hawai‘i at Mānoa Center for Oral History (2013), H-Oralist (2011), and the Oral History Association (2000))

University of Hawai‘i at Mānoa

Department of Educational Foundations

Agreement to Participate in

A Proposed Case Study on Ethnic/Cultural and Professional Identity Salience

with Native Hawaiian Members of Hawai‘i’s Science Community

Franklin S. Allaire, Primary Investigator

My name is Franklin Allaire and I am a doctoral student with the Department of Educational Foundations at the University of Hawai‘i at Mānoa. I am conducting a project to document the oral histories of people of Native Hawaiian ancestry who are members of Hawai‘i’s science, technology, engineering, and math (STEM) community. I am asking for your participation in this project because you are part of these communities.

Activities and Time Commitment: If you agree to participate, I will interview you three times in a place that is convenient to you. The interview(s) will last about 60 minutes each. I will record the interviews using a digital audio recorder. The interviews will be informal and conversational. I want to get your personal experiences being Hawaiian and a member of Hawai‘i’s science/technology community.

After the interviews I will transcribe the recordings, that is, type a written record of the interviews. I will then check and edit the transcript for accuracy. Then, I will send you the transcript so you can make any changes that you would like. I estimate that it will take you from 5 to 6 hours to do this, depending on how many changes you indicate. We will then incorporate your revisions into an official transcript that will be used to augment the final written dissertation.

Voluntary Participation: Your participation in this project is voluntary and you may withdraw from participation at any time, up to the completion date of this project, which is expected to be February 2012. During the interviews, you can choose to not answer any question(s) at any time for any reason. If you disapprove of, wish to change, add to, delete, or otherwise change the transcripts or the audio file of the interviews, you may do so at any time up to the completion of this project. If you decide that the transcripts and/or audio files should not be archived, we will end the project.

Benefits and Risks: There is no direct benefit to you in participating in this research project. However, your participation will contribute to the historical record of Native Hawaiians in the STEM community. While there are no direct benefits, there are
potential risks in your participation. One potential risk to you is a loss of privacy. Another potential risk is that some topics we discuss during the interviews might bring back painful or unpleasant memories. In such cases, we can take a break, skip that topic, and/or you may choose to stop participating altogether.

**Privacy and Confidentiality:** In order to protect your privacy, I will ask you to choose an appropriate pseudonym for this project. The pseudonym you choose will be used on all print and digital documentation and analysis in this project. It will also appear in the finally dissertation and could potentially be used in publication. Only I, as the primary investigator, will know your identity. As an additional level of protection, you retain the right to change, delete, or add information in the transcripts and audio-video files.

**Questions:** Please contact me, Franklin Allaire, at (808) 282-9454 or allaire@hawaii.edu if you have any questions regarding this project. If you have questions about your rights as a research participant, contact the UH Committee on Human Studies at (808) 956-5007 or via email at uhirb@hawaii.edu.

---

**Agreement to Participate in**

A Proposed Case Study on Ethnic/Cultural and Professional Identity Salience with Native Hawaiian Members of Hawai‘i’s Science Community

“I certify that I have read and that I understand the information in this consent form, that I have been given satisfactory answers to my questions concerning the project, and that I have been told that I am free to withdraw my consent and to discontinue participation in the project at any time without any negative consequences to me.

I herewith give my consent to participate in this project with the understanding that such consent does not waive any of my legal rights.”

____________________
Printed Name of Interviewee

____________________
Signature of Interviewee

____________________
Date
### Appendix D: Narrator Data Sheet

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Table of Contents
Appendix G: Case Study Method
Adapted and Adopted from Yin (1994)

Define and Design

Select Cases
Design Data Collection Protocol
Develop Research Questions

Prepare, Collect, and Analyze

Conduct 1st Case Study
Write Individual Case Report

Conduct 2nd Case Study
Write Individual Case Report

Conduct Remaining Case Studies
Write Individual Case Reports

Analyze and Conclude

Make Cross-case Connections
Connect to Literature
Generate Theory Grounded in Data
Write Cross-case Report
Develop Policy Implications

Conduct Remaining Case Studies
Write Individual Case Reports
Generate Theory Grounded in Data
Write Cross-case Report
Develop Policy Implications
NOTES

1 Hawaiian words in this piece are not italicized as foreign words, following the usage adopted by the editors of the 1997 issue of Social Process in Hawai‘i (vol. 38) and as used by Merry (2000) in Colonizing Hawai‘i: The Cultural Power of Law. Like Merry, “I recognize the Hawaiian language as indigenous to the place I am writing about rather than the language of a foreign country” (xiii).

2 All the names in this project and dissertation are pseudonyms chosen by the participants to help protect both their own anonymity as well as the anonymity of their friends, families, and colleagues.

3 In addition to these communities, I feel that this research project will also be beneficial to the science, science education, and general education communities.

4 This dynamic has the potential to be exacerbated with female Native Hawaiian participants because of the resulting two binary (Hawaiian / Non-Hawaiian and Male / Female) dynamics that will exist.

5 This is a literary term that describes the creation of a fictional character in a historical setting to personify a particular era and to help readers connect with the storyline. I am using this term to describe a psychological process where the victim of historical trauma (i.e. colonization) directs his/her anger, frustration, and blame towards an individual that had nothing to do with the actual traumatic event.

6 In this project and dissertation I will use the terms “participant(s)” and “narrator(s)” interchangeably. This usage follows recommendations by Charmaz (2006), Creswell (1998), Lincoln & Guba (1990), Merriam (2001), and Smith (2004) and reflects not only the oral history narration each individual provided but also their active participation in the meaning making process for this project.

7 Known as the “father of the atomic bomb” for his role on the Manhattan Project, Oppenheimer later came to regret his role and lobbied for international control of nuclear power and weapons.

8 A chemist who specialized in X-ray crystallography, Franklin took the first “photograph” of DNA leading the discovery of its structure.

9 Chemist and peace activist, Pauling in one of four people to have received two Nobel Prizes and one of two people to receive them in two different fields (Chemistry and Peace).

10 A 19th century chemist whose fame rests on the discovery of the structure of benzene (C6H6), Kekule claims the structure came to him in a dream he had about a snake seizing its own tail forming an ouroboros.

11 Marine biologist, Carson is responsible for examining the effects of pesticides (particularly DDT) on wildlife and advancing the modern environmental movement through her book Silent Spring.

12 “In a sense colonialism has reduced indigenous peoples to making claims and assertions about (their) rights and dues” (p. 143). Reclaiming, therefore, is not only a personal process but can also be a legal process.

13 This project has a “centering of the landscapes, images, languages, themes, metaphors and stories in the indigenous world (p. 146)” that have enabled Hawaiian science teachers to negotiate through their professional and personal lives.

14 Envisioning mirrors the Dreaming step in the decolonization process which “asks people (to) imagine a future, that they rise above present day situations which are generally depressing, dream a new dream and set a new vision” (p. 152).

15 “Story telling and oral histories (p. 144)” are fundamental parts of Hawaiian culture and have thus become vital to research with Hawaiian people. “Each individual story is powerful. But the point about the stories is not that they simply tell a story, or tell a story simply. These new stories contribute to a collective story in which every indigenous person has a place.”

16 “Reframing is about taking much greater control over the ways in which indigenous issues and social problems are discussed and handled (p. 153).” This issue is key is the examination of the plural identities Hawaiian science teachers have as opposed to the singular identities the literature claims.

17 (Re)naming is about “retaining as much control over meanings as possible” (p. 157). Naming the world enables people to define their reality.

18 Protecting “is concerned with protecting peoples, communities, languages, customs and beliefs, art and ideas, natural resources and the things that indigenous peoples produce (p. 158)” and is the basis for interviewing participants rather than utilizing only
This concept “is about discovering Western science and technology and making science work for indigenous development (p. 160).” Even according to Smith there are “very few indigenous scientists who remain closely connected to their own indigenous culture.” The goal of this project is to find out how Hawaiian science teachers have negotiated two major facets of their lives and whether being a science teacher indeed inhibits their ability to be Native Hawaiian.

There are of course subtle differences between the ecologies and subsequent trauma suffered by various Indigenous Peoples including Maori, Aboriginal, Hawaiian, First Nations Peoples, Inuit and Native Americans in the Americas.

In this case, I use the term “land” to refer to the land, air, water, wind, weather and geographical features that shape the lessons, myths, legends, and traditions of an Indigenous culture.

There are a variety of terms that can be used to describe people of Hawaiian ancestry including Native, Hawaiian, Native Hawaiian, Kanaka Maoli, and Indigenous Peoples. I will try to limit my use to the terms Kanaka Maoli, Native Hawaiian and Hawaiian unless specifically citing a reference.

Terror management theory (TMT) Terror Management Theory (TMT) posits that culture is created to act as an anxiety buffer against both real and symbolic death. “Humanly created symbolic perceptual constructions shared by groups of people to minimize the anxiety associated with the awareness of death. [Culture] imbues the world with meaning, order, stability and permanence, and by doing so, buffer the anxiety that results from living in a terrifying and largely uncontrollable universe” (Solomon, Greenberg, and Pyszczynski 1991, 96). Accordingly, cultural groups create complex systems involving language, symbols, and norms that extend beyond the self to a social and existential level. “Feeling that one is a part of something larger and significant is often fulfilled by group identification” (Walsh and Smith 2007). Academic psychologists have historically repudiated existential psychodynamic accounts of human behavior on the grounds that they cannot be empirically tested. TMT stands in stark contrast to this claim. A substantial body of empirical evidence now supports the basic tenets of TMT. TMT has attracted the interest and engaged the efforts of scholars in a variety of disciplines throughout the world and has generated research on a range of topics far beyond the original scope of the theory (Greenberg 1990, 1992, Rosenblatt 1989, Solomon, Greenberg, and Pyszczynski 2004, Solomon, Greenberg, and Pyszczynski 1991).

I use the term identity to describe a person’s chosen and unchosen identities, especially in terms of epistemology, ontology and pedagogy.

I was unable to ascertain from the article if this view of the United States and its “white, male dominated power structure” was stated by Lynne Cheney or was inserted by the authors.

Literally navel, navel ring, umbilical cord. Also refers to the spiritual center.

These terms should not be confused with terms with negative connotations such as dehumanization and deindividuation.

The concept of identity hierarchy as it pertains to person(al) identity, identity salience, and psychological centrality will be explored in more detail later in this chapter.

I say, “racial identity research has been limited to Blacks/African Americans” because white researchers did not view research with white (dominant) members of society as “racial identity research” leading to assumptions and inequalities. As a result, “racial” research was and to a certain extent is still seen as research involving non-whites.

Some researchers both for and against so-called Indigenous/Native Science have referred to this process as “elevating” the status of Indigenous knowledge. I have chosen not to use this word because it automatically implies that Indigenous knowledge has a lower status and/or is less important that “scientific” knowledge. This power relationship inhibits discussion rather than fostering it.

I will use the term Indigenous science to represent Indigenous science, native science and traditional ecological knowledge (TEK).

Women, other Indigenous groups (i.e. Maori and Aboriginal), African-Americans, Latino/as, and Asians

The doctrine that all events, including human action, are ultimately determined by causes external to the will. Some philosophers have taken determinism to imply that individual human beings have no free will and cannot be held morally responsible for their actions.

The doctrine that all phenomena, including human phenomena, are ultimately subject to a single set of laws.
Research in which all aspects of the research, from problem definition through instrumentation, data collection and analysis, and use of findings, have been solely researcher-determined to the virtual objectification of the research subject(s).

Research in which the respondents/participants have equal rights to determination.

Objective reality asserts there is a tangible reality, and experience with it can result in knowing it fully (i.e. scientific experimentation and investigation) (82).

Perceived reality asserts that there is reality, but one cannot know it fully and it can be appreciated only from particular vantage points called perceptions (83).

Reality is a construction in the minds of individuals therefore it is dubious whether there is a reality. If there is, we can never know it (83-84).

There is no reality at all. Reality does not exist until it is realized during which time the individual is responsible for the creation of his/her reality as well as potential alternate realities (see Schrödinger’s cat).

This included informally “talking story” with each of the participants about who I am, the purpose of the project, and my overall intent. It also included time for the narrator to gather their thoughts. Some interviews took place at the participant’s place of employment. Therefore, warm up questions included “so what’s a typical day like around here?”

Meaning, in this context, will not necessarily address “satisfaction or reward…rather, it addresses the intellectual and emotional connections between the participants’ work and life” (Seidman 2006, 18).

See Appendix A for the interview protocol based on previous research as well as recommendation from Lincoln and Guba (1985), Seidman (2006), Stewart (2008, 2009) and Yow (2005).

This project has a “centering of the landscapes, images, languages, themes, metaphors and stories in the indigenous world (p. 146)” that have enabled Hawaiian science teachers to negotiate through their professional and personal lives.

“Story telling and oral histories (p. 144)” are fundamental parts of Hawaiian culture and have thus become vital to research with Hawaiian people. “Each individual story is powerful. But the point about the stories is not that they simply tell a story, or tell a story simply. These new stories contribute to a collective story in which every indigenous person has a place.”

“Reframing is about taking much greater control over the ways in which indigenous issues and social problems are discussed and handled (p. 153).” This issue is key is the examination of the plural identities Hawaiian science teachers have as opposed to the singular identities the literature claims.

Protecting “is concerned with protecting peoples, communities, languages, customs and beliefs, art and ideas, natural resources and the things that indigenous peoples produce (p. 158)” and is the basis for interviewing participants rather than utilizing only literature.

This concept “is about discovering Western science and technology and making science work for indigenous development (p. 160).” Even according to Smith there are “very few indigenous scientists who remain closely connected to their own indigenous culture.” The goal of this project is to find out how Hawaiian science teachers have negotiated two major facets of their lives and whether being a science teacher indeed inhibits their ability to be Native Hawaiian.

This online survey asked for basic biographical information such as age, level of education, and area of study so that I could ensure the widest range of participants possible.

I use “scientists” as a catch-all term referring to all science, technology, engineering, and mathematics related fields.

I use the term raw transcript to refer to a transcript that had little to not editing. There were the words the narrator spoke, the way they spoke them. Several of the participants commented that reading their own words, especially in raw form, was an “interesting” experience causing them to become a little self-conscious during the second interview.

“Word-by-word analysis forces you to attend to images and meanings. You may attend to the structure and flow of words, and how both affect the sense you make of them, as well as their specific content” (Charmaz 2011, 50).

“Line-by-line coding forces the researcher to verify and saturate categories, minimizes missing an important category, and ensures relevance by generating codes with emergent fit to the substantive area under study” (Holton 2010, 275).

Some grounded theory researchers believe “making comparisons between incidents likely works better than word-by-word or line-
by-line coding, in part because…behavioristic descriptions of people’s actions may not be amenable to line-by-line coding, particularly when you observe a scene but do not have a sense of its context, its participants, and did not interact with them” (Charmaz 2011, 53).

56 In vivo codes “generally refer to codes of participants’ special terms...(that) provide a useful point of departure...(and) help preserve participants’ meanings of their views and actions in the coding itself” (Charmaz 2011, 55). An example of in vivo coding for this project includes the recognition and use of pidgin in narrative excerpts.

57 Charmaz (2011) cites Glaser’s (1992, 1978) use of theoretical coding following focused coding precluding the need for axial coding. Whereas axial coding is about unpackaging deeper meanings within larger categories, Glaser sees theoretical coding as integrative with the ability to “weave the fractured story back together” (63). While I may have used certain aspects of theoretical coding to repackage disparate themes back into larger categories using analytic categories outlined by Glaser such as “causes,” “identity-self,” and “cultural” I don’t feel I used it as a genuine method during my coding process. Therefore, I don’t feel the need to examine its use and impact on my coding process more than I’ve already done.

58 Melemele chose to exercise this option when she withdrew from the project citing personal/family reasons. Fortunately, she allowed me to use her story in this dissertation.

59 Withdrawal/Refusal could be for an individual question, the interview, and/or the process as a whole.

60 This could include “guarantees of control over interpretation and presentation beyond the scope of restrictions stated in the informed consent/release forms, suggestions of material benefit outside the control of the interviewer, or assurances of an open ended relationship between the narrator and oral historian” (OHA 2000).

61 Participants were asked to choose a pseudonym to be used for the purposes of this project. Since this is a project with members of the Native Hawaiian community, participants were asked to choose a Hawaiian name or word to be their pseudonym.

62 Meaning, in this context, will not necessarily address “satisfaction or reward…rather, it addresses the intellectual and emotional connections between the participants’ work and life” (Seidman 2006, 18).

63 At the time of this research project Keala, Melemele, and Hīhīmanu were undergraduate students and had not yet determined if they would pursue graduate degrees.

64 The participant’s sense of place included both where they were physically located (i.e. environment, geography) and mentally, emotionally, and spiritually located.

65 Scientist is typically a noun, however in the analysis of multiple dimensions of identity I will use scientist as an adjective to describe the dimension of the participants’ professional identities as opposed to expressing them individually (i.e. doctor, engineer, chemist, astronomer). Additionally, this term differentiates between this dimension of identity from the many other dimensions the participants possess (i.e. male/female, married/single, Hawaiian). This follows similar grammatical usage in the scholarly works of Abes and Jones (2004), Abes, Jones, and McEwan (2007), Jones (1997, 2009), and Jones and McEwan (2000).

66 Gibson (1991) defines the term minority as “a group occupying a subordinate position in a multiethnic society” and nonimmigrant minority as “those who are native born” (358). Furthermore, she defines the term involuntary minority as “a group brought involuntarily into a subordinate relationship with the dominant group of their present societies and subsequently treated to a history of denigration, exclusion, and unequal educational and economic opportunities” (365).

67 Underrepresented minority

68 University of New Mexico

69 Keala also felt that his homosexuality also made him different from other people. Keala spoke at length about pretending to be straight and how he isolated himself from others because he did not want them to know he was gay.

70 Third-year undergraduate coursework for Biology majors.

71 Tuākana derives its name from Maori for older sibling. Hānau mua has the same meaning.

72 These particular questions regarding identity “ownership” stem from literature on similar studies involving cultural identities as they relate to the sciences. Additionally, all of the participants from my previous research spoke of concerns relating to identities, particularly Hawaiian identity, being hijacked and used to exclude those who may not “measure up” to their standards.
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