

More than Just Playing Outside: A Self-Study on Finding My Identity as an Environmental Educator in Science Education

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The purpose of this study was to investigate the identity conflicts I was experiencing as an environmental educator entering a doctoral program in science education. My inquiry used self-study methodology with a variety of data sources, including sixteen weeks' of personal journal entries, audio-recordings of four critical friend meetings, and three instructor evaluations completed by my students. Findings from this study show a progression of thoughts, emotions, and questions that came out of my comparisons of environmental education and science education, formal, and informal education, as well as three critical instances that led to an understanding of my own professional identity. Overarching connections were found within pedagogical practices. Implications regarding the need for life-long teacher reflection as well as suggestions for ways to build bridges across differing educational fields are discussed.

Keywords: self-study, identity, environmental education, science education, critical instances, pedagogy

INTRODUCTION

This study resulted from a series of questions that kept racing through my mind when beginning my first year of doctoral work. Although I entered the science education program confident that I, as an environmental educator, belonged in the field of science education, I soon encountered many conflicting feelings. I struggled with finding my identity within the program and began to question my role within both the science and environmental education fields. This self-study explored that struggle. The research was grounded in understandings of identity formation, with implications for a person crossing the border between the environmental and science education communities. I, along with two critical friends (Gayle and Valarie),

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utilized journal entries, critical friends meetings, and student evaluations to understand my identity formation across these two communities. Three categories emerged from the data analysis: (1) comparisons between environmental and science education, (2) critical instances, and (3) finding ground in pedagogy. Considering the importance of identity in teacher education, these findings have implications for both the science and environmental education fields as well as for educators transitioning from differing communities of practice.

Review of relevant literature

This self-study was grounded in the literature on professional identity formation and the complexities of merging science and environmental education. This grounding is provided below.

Professional identity formation

Research on identity formation in pre-service and/or novice science teachers became quite common during the beginning of the 21st century (Avraamidou, 2014; Eick, 2002; Luehmann, 2007; Luft & Roehrig, 2007; Saka, Southerland, Kittleson, & Hutner, 2013; Settlage, Southerland, Smith, & Ceglie, 2009; Varelas, House, & Wenzel, 2004). Gee (2005) states that one's identity is the recognition of the self by oneself or others as a certain "kind of person." Identity development, and professional identity development specifically, is the means by which one becomes a full participant of a community of practice (Lave & Wenger, 1991). According to Wenger (2011) communities of practice consist of groups of people who share a common concern or a passion for something they do and learn how to do it better as they interact regularly. Luft and Roehrig (2007) claim that recognizing one's personal constructs of identity can provide an understanding of a teacher's practice, including instruction and management. Day, Kington, and Gu (2005) support this by adding that identity may be the fundamental construct for understanding teacher effectiveness and improvement. Within this study, I was struggling to determine which community of practice to which I would belong.

Brickhouse, Lowery, and Schultz (2000) note that identity is not necessarily singular or stable. A person can be a part of many different communities. With identity being shaped by interactions with oneself and others, identity becomes multifaceted, ever-changing and a dynamic process (Lemke, 2003; Saka et al., 2013; Zembylas, 2003). Settlage et al. (2009) adds some insight into this idea by stating that

A misperception about identity development is that it represents an embryonic force waiting to be released. Rather than imagining identities as somehow hatching from within, it is more appropriate to regard identities as being constructed within a sociological context. As such, identity development is not the disclosure of a way of being that becomes stabilized once it surfaces. Instead, identities develop in concert within interactions with other individuals (p. 105).

Zembylas (2003) referred to the concept as the "messy-meanings of teacher identity," those that arise from changing social interactions and cultures. His work highlighted the importance of giving attention to the emotions that interplay behind our outward identities.

With the ever-changing school system as well as the myriad of types of educators, one individual educator often finds themselves teaching within a variety of settings. This act of transitioning from one place to another, one community of practice to another, and even one culture to another can be looked at as a form of border crossing. Border crossing is most commonly known for referring to students who

make transitions from their home environment to their educational environment and the differences they may confront. Students are constantly altering beliefs, expectations, and conventions (Aikenhead, 1996). Saka et al. (2013) further states that context also significantly affects the shaping and re-shaping of teacher' identities not only those of their students. Leavitt (1995) indicates that for students, the teachers can take on the role of the "tour guide" in some respects to help students transition more smoothly across the different borders they may be facing (p. 24). For us teachers who are crossing our own borders, who will act as our tour guide to help us transition more smoothly? Several researchers hint that there may certainly be bridges to build.

Varelas et al. (2004) conducted a study based on a 10-week fulltime summer apprenticeship in a science research laboratory. In this study participants were asked to be scientists in some settings and science teachers in others. Through the lens of "identity" the researchers looked at the interplay between participants taking on these two different roles. Results indicated that when participants were able to form a hybrid identity, one that acknowledged both the differences and the similarities between the two varying roles and then merged them together, they were able to navigate their professionalism in both practices. This idea of building a bridge between two varying identities even allowed the participants to challenge and reshape parts of both practices. Settlage et al. (2009) provides further insight into this idea of new identity formation in their paper on the teacher-self. Instead of identity only representing an accumulation of experience, it can rather be looked at as a wandering path that is formed as the individual moves from one space to the next. Finally, Avraamidou (2014) summarizes three main characteristics seen across the literature in relation to defining teacher identity: 1) teacher identity is socially constructed; 2) teacher identify is dynamic; and 3) teacher identity is complex and multifaceted. Avraamidou also highlights that: a) identity can be a powerful tool to explore teacher learning and development, b) context plays a significant role within identity formation, c) exploring identities can illuminate individuals' histories in relation to their area of focus, and d) social markers (i.e. age, gender, emotions) can be examined through identity. Within this study I sought to develop my own identity within a community of practice.

Complexities in merging environmental and science education identities

In breaking down the last 30 years of environmental education research, Sauvé (2005) created 15 different currents of interventions. This mapping looks into the typology of the different practical and theoretical propositions underlying EE research and practice. She labels this "a mapping of the pedagogical landscape of environmental education" (pp. 1). The 15 currents identified within EE practice and theory include: naturalist, conservationist/resourcist, problem-solving, systemic, scientific, humanist/mesological, value-centered, holistic, bioregionalist, praxic, socially critical, feminist, ethnographic, eco-education, and sustainable development /sustainability. These currents provide grounding for environmental educators to explore their own identity within the field. In looking at this typology in comparison to science education the value-centered current stands to represent an area of high contention. There are a number of researchers who see problems with the overall epistemological and ontological underpinnings between science and EE. The problems are not seen in looking at the underpinnings of each field separately, but rather when looking at trying to merge them together. Science is often portrayed in a modern perspective, focusing on objectivism and value-free investigations (Gough, 2002; Hart, 2007; Hungerford, 2009). This portrayal can be most associated with

Sauvé's scientific current. Through this lens the environment is explored predominantly through knowledge and skill development in observation and experimentation associated within environmental science. The environment often serves as the "hook" (p. 17) to stimulate interest in students. In contrast, the value-centered current prioritizes the relationship of humans to the environment in having moral and ethical implications, thus an environmental educator's values play a central role in determining what and how EE is taught and also serves as an important area of exploration for students within the field.

Although the number of studies on the transition from formal classroom teaching to teacher education is growing (Williams, Ritter, & Bullock, 2012), there remains a contemporary gap within the teacher identity literature (Avraamidou, 2014). Avraamidou (2014) explains that studies are missing that foster an understanding of how teachers construct and reconstruct their identities across various contexts. An insufficient exploration of the influence that informal science contexts have on the development of teacher identity, like many of those within the EE field, was noted. My questions regarding the identity conflicts I was experiencing as an environmental educator entering a science education community fits within this gap.

Purpose

Finding myself in a science educator role when I had been identifying myself solely as an environmental educator caused many internal conflicts. The purpose of this self-study research was to work through those conflicts. The study was guided by two overarching questions: (1) What is my identity as a science educator and as an environmental educator? and 2) In what ways can I bridge the differences between varying fields of practice that I may find myself working in to help find a sense of balance between these multiple settings?

METHODS OF STUDY

A self-study methodology was selected in light of the need to explore my own identity in these varying fields of practice. Self-study is the intentional and systematic inquiry into one's own practice. It can be seen as a tool to promote the reflective teaching that is essential in education (Dinkelman, 2003). Dewey (1916) argued that the very test of whether an experience is educative rests in whether that experience instills a deeper appreciation for and understanding of future experience. Reflection allows for the reconstruction and reorganization of one's teaching practice to promote positive change for the teacher and the learner. Dinkelman further states that reflections made through self-study can also allow for teachers who find themselves in settings other than their norm to adapt and find a greater sense of place. "Self-study research is used to provoke, challenge, and illuminate rather than to confirm and settle" (Bullough & Pinnegar, 2001, p. 20). A defining feature of self-study stems from collaboration with others to provide challenges to ways of thinking and help generate mutual understanding (Berry & Russell, 2014; Coleman & Leider, 2014; Lighthall, 2004; Weibke & Park Rogers, 2014). The theoretical underpinnings of self-study come from epistemological origins (LaBoskey, 2004). These origins consist of understanding how we know what we know and how our experiences shape and mold the way we understand and make-sense of what has been and what will be (and thus how we teach that to our learners). Self-study allows for educators to have an opportunity to reconstruct and reorganize their own identities by looking deeply into the roots of their own identity formations over time. Coleman & Leider (2014) conclude their self-study research in new curriculum development and implementation by reflecting that,

“systematically examining and analyzing our teaching through self-study influenced and continues to shape our beliefs, values, and practices as educators,” (67). In this light, self-study is seen as a knowledge-of-practice that informs the individual to thus inform and enhance their practice (Cochran-Smith & Lytle, 1999).

Context of the study

This study took place over a sixteen-week period of time corresponding to the spring semester at a public university in the USA. During this time, I was enrolled in four graduate courses in science education, continued to work on integrating into the higher education environment, interacted with new colleagues, and taught two sections of a science course for prospective elementary education undergraduate students. The goals of the course that I taught were to examine the nature of science, enhance understandings of scientists and scientific careers, experience constructivist inquiry-based interactions, develop and refine lab skills as well as making relevant life decisions based on evaluating credible scientific evidence, and conducting science inquiry through the theme of environmental activities that adhere to the National Science Education Standards. The amalgam of complex pieces that encompassed the doctoral program greatly challenged my prior way of knowing as I held an identity as an environmental educator.

Gayle and Valarie acted as critical friends throughout the study. Gayle worked with me on conceptualizing the study and outlining important means of data collection. Both Gayle and Valarie took part in four reflective meetings. During these meetings, they pushed my thinking further by asking for clarification, suggesting alternative explanations to consider, and identifying areas where I needed to dig deeper in my own thought processes. These critical friend opportunities allowed for elements of my study to be revealed that I myself would not have seen (Pinnegar & Hamilton, 2009). I also used these meetings as a means to enhance the validity and reliability of the study by allowing my interpretation of the findings to be explored and questioned (Loughran & Northfield, 1998).

Data collection and sources

The primary data sources for this study were the written personal journal entries and transcriptions of the critical friends meetings. The supporting data sources included instructor evaluations filled out by my students. The journal entries included my own thoughts and reactions to the lessons I was teaching, my interactions with the students and the content, as well as any other situations I encountered which posed relevance to this exploration. These entries spanned the entire four months of the study. The four critical friends meetings were held with Gayle and Valarie. These meetings focused on discussing where my thoughts were in relation to my identity as a science educator and/or as an environmental educator, any critical instances that occurred, and my journal entries. Critical instances are moments in which I came to a newfound realization that helped to re-shape and change my views and perspectives. Data were also collected by means of three course evaluations completed by my students. This supporting data was used to compare the students' and my beliefs about the effectiveness of my teaching.

Data analysis

A process of open coding was used to break down my critical friend conversations and journal entries to look for similarities and differences within the words used and thoughts/ideas expressed. These similarities were given conceptual

labels so they could be grouped together to form categories and subcategories (see Table 1).

Table 1. Open-Coding Categories and Sub-Categories

Category	Sub-Category
General	N – Negative Comment P – Positive Comment TO – Teacher Observation SO – Student Observation
Comparisons	INF – Informal Education Definition F – Formal Education Definition I – Identity defined by what I have known LK – Lack of Knowledge WC – Ways of Coping Q – Questioning EE and Science Education
Critical Instances	I – Identity in relation to Feelings of Home/Niche CI – Critical Instance Q – Questioning my place within the Science Ed. Program RD – Redefining Definition – Thoughts H – Home and/or Niche
Finding Ground	I – Identity as a Professional C – Connecting Formal and Informal Q – Questioning how my formed identity can express itself
Pedagogy Style	SR – Student Relationship T – Element of Time PS – Pedagogy Style I – Identity as an Educator Q – Questioning education and teaching in general

This process of open coding and category generation was emergent. As new ideas were expressed throughout the study, new themes and categories were created. Data collection and analysis were interrelated. Once aware of differences in categories, a constant comparison method was used to explore the nuances within each – the patterns and variations (Corbin & Strauss, 1990). As Corbin and Strauss define, by using systematic comparisons throughout the entire data collection period, errors in misplacing data in a category where it may not analytically belong was eventually re-located into its appropriate classification. As the initial coding process was completed, I shared these with Gayle and Valarie, as co-researchers, to help verify the codes generated, categories created, and data placement within.

FINDINGS

Throughout the analysis process a clear progression through the 16 weeks of the study could be seen in my thinking and reasoning as an environmental educator in a science education program and the means in which varying fields and identities can be bridged. The findings have been outlined within three themes: Making Comparisons, Critical Instances, and Finding Ground in Pedagogy. These themes help to demarcate distinctions within the data through time to answer the main research questions of this study. For each theme, a brief overview of the journal entries, critical friend meetings, and instructor evaluations that took place within the time period of that theme is provided. Following this overview are the data that help to illustrate progressions in thinking and reasoning.

Making comparisons

Data grouped under this category all related to definitions of environmental education, science, formal, and informal education, thoughts on identity conflicts, ways in which I was coping with unfamiliar or changing situations and content, feelings of a lack of knowledge in a new field, and general questions about all of these subcategories. A “General” category was also created. This category included all data that had been coded as being a positive or negative comment, and/or an observation of me as the teacher and of the students. Coding under these subcategories followed through all weeks of the study.

My self-study began in the middle of winter 2014 at the start of the spring semester. I had returned to campus from a two-week break in my hometown. From the very first day of my return I began writing down my thoughts and feelings toward this new semester as a student in the science education doctorate program and as an associate instructor for pre-service elementary science teachers. Much of what I wrote about during the first week focused on my initial feelings of being “nervous” and “frazzled” (Journal Entries, January 2014). Alongside of these general feelings of apprehension was also a series of constant comparisons I kept internally making. These comparisons focused on the differences I felt in being a classroom instructor and an environmental educator. They also led me to question field of environmental education versus science education.

In EE the “instructor” is more of a co-discoverer with the students, while in the classroom there is a clear distinction between the teacher and the student (Journal Entry, 01/13/2014).

[Classroom science] is often an isolated incident with no direct connection to a student’s actual life, whereas in EE you are often out in the element you live in (Journal Entry, 01/15/2014, 01/27/2014, and 02/19/2014)

[In EE] there is room for surprise and unexpectedness. There is real inquiry, not “forced inquiry” like in the classroom, because EE is inquiry (Journal Entry, 01/27/2014)

Reflections from my first three weeks of teaching led me into my first critical friend meeting. This meeting focused largely on identifying my own internal struggle with identifying myself as an environmental educator and a science educator. Selected excerpts from the conversation are included below.

Gayle: So are you comfortable teaching environmental education in the classroom?

Jenna: My first response is that is a contradiction in and of itself. When it can, most environmental education takes place out in the atmosphere and environment you are teaching and learning about. Lessons are based off of the location you are at and are not conducted within four walls.

Gayle: So it’s not as much of a matter of hands-on, but being inside?

Jenna: It’s definitely hands-on too...learning happens when we do something with our hands...

Gayle: So what is science education?

Jenna: I don’t know!...I feel uncomfortable when I say I’m a science educator or that I am a science education researcher because those are parts are so different from EE and I only feel qualified in EE.

Valarie: I can see that. The field is huge, but we all talk the same language.

Jenna: If people say EE, I feel very comfortable. If they say science education I get very uncomfortable and say, “that’s not what I do.” I

guess I just don't have my own definition of what science is and what my role is as an educator (Critical Friend Meeting, 01/23/2014).

After this meeting I felt compelled to try and write down how environmental education connects to the seven Nature of Science (NOS) aspects, the key foundation to science education (Lederman, 2010). I found making this connection rather simple. In science and in environmental education our work is tentative, based on observation and inference, uses theories and laws, uses empirical evidence, is creative and imaginative, can be objective and subjective, and is socially and culturally embedded. I also could see how science and science education fit into the five pillars of environmental education: awareness, knowledge and understanding, value creation, skill development, and action (Stapp, 1969). I used an analogy to try and connect these ideas together: "Maybe EE has its roots in the Nature of Science, its trunk in Inquiry itself, the branches are the teachers/educators/scientists/researchers, and its leaves are the greater population of learners" (Journal Entry, 02/12/2014). This analogy led me to question whether I might actually be a 'branch.' This question I continued to ponder throughout the second critical friend meeting. The meeting largely focused on seeing what connections I could make between science education and environmental education as well as initial touches on pedagogy that will be discussed further within the third stage of results for this study.

My students completed their first round of instructor evaluations at the end of the fifth week of the semester. Surprisingly, I received top marks from most students on communicating ideas and concepts confidently and demonstrating a thorough grasp of the course material. The students, however, often commented that I needed to use more examples. I was teaching in what appeared to be a confident and knowledgeable manner, but I still lacked the ability to really connect what I was teaching with everyday life for the students (and for myself). These responses paralleled my reflections throughout the sixth and seventh week of the semester.

I definitely feel like I am in some sort of flow. I am not questioning myself as much anymore. Maybe it's okay to have my favorite places to work (outside doing environmental education), but that doesn't mean I can't work productively in other environment...I never internalized EE as a component of science...I also think that I am able to learn more and understand more than I thought I could - using resources, asking a lot of questions, and not being embarrassed if I don't know something (Journal Entry, 02/26/2014).

At this point of my self-study, I felt like I had reached a lull in my reflections. In some ways I had found a sense of peace in saying that science education and environmental education were under the same "umbrella" and I had the ability to do both. This "lull" did not last for long.

Critical instances

Data grouped in this category all related to critical instances in which profound emotions and thoughts were based on an external trigger, developing definitions of my own identity, redefining my own previous definitions and thoughts, references to feeling at home or finding a niche, as well as questioning these subcategories.

After the lull experienced at the end of the seventh week of my study, I truly felt that I had come to peace with describing environmental education as one component of the broader science education field. Because I was able to connect with EE, I then could also connect with science education. Approximately two months into the study, I attended a science education research symposium followed by a gathering of research from the broader educational community of curriculum

and instruction. My experiences on this day of events took me the weekend to process:

I went to the Science Education Research Symposium and [C & I Conference] on Friday. I felt completely out-of-place. I felt more at home in the museums and docent training session than in any of the science education presentations. It seems ever more apparent that EE is a science within itself (Journal Entry, 03/03/2014).

This experience challenged me to reshape my prior understandings. As mentioned in the literature review of this study, critical instances are moments in which I came to a newfound realization that helped to re-shape and change my views and perspectives. This day of presentations was my first critical instance.

One week after this experience, I had another critical instance. I went to speak with a professor from a different college within the university. The professor was currently focusing on outdoor education and its impact in children's health and wellness, however his past credentials name him as a leader in the environmental education field. This latter affiliation led me to think he may be someone I should meet. During our first meeting, he invited me to work with him on several research projects. Reflections made after this meeting help to demonstrate yet another critical instance during this study.

[I] spoke with [professor] about doing some research with him at Bradford Woods and maybe even on global change. I felt completely at home. I felt that feeling of contentment when you have found your niche and you feel like you'll be able to operate to your full potential. I have a place in EE. In science education, I can be on board with more interactive learning and teaching, but the base for the two fields is different. EE really focuses on values toward nature and our actions. It focuses on taking action to make positive changes within our environment. That is the heart of EE. That is what I love about it. It's beyond the school system, beyond just acquiring knowledge. It's about truly trying to become a part of a larger community that lives, breathes, and interacts on this planet. What is my role? To reconnect people with this feeling of belonging, responsibility and understanding. (Journal Entry, 03/10/2014)

Very clearly this passage shows a newly found sense of place, specifically within the field of environmental education. I identified with the value system, interdependence, and connection with nature. These feelings of finding a "home" and my "niche" were further defined when I stumbled upon a third critical instance less than two weeks later.

During the ninth week of this study, I conducted an unstructured interview for an assignment in my research methods course. My former supervisor for a naturalist position I held six years prior happened to be in a doctoral program at my same university. I jumped at the chance to have him tell me his life story. The emotions I felt while conducting this interview were transforming and insightful.

[I] cannot express the sense of being home and completely on the same page as someone else. Science education and environmental education are fundamentally different fields. I feel a lot more comfortable not trying to make EE fit under the Science education umbrella...like fitting the proverbial round peg into a square hole. I will say that they can share commonalities in discovery and place-based learning and inquiry (Journal Entry, 03/12/2014).

Again, "home" appears predominantly in this journal passage. It is here again that I make a clear distinction that I identify myself as an environmental educator. It is also here that I hint at ways I see that the two fields may cross-over. These ideas continued when I had my third critical friend meeting. We discussed each of my

critical instances and how I was feeling in relation to my identity within the program. I reflected on the distinctions between the fields as well as my place within each. Below is an excerpt reflecting these ideas.

Jenna: I think I had accepted that this is a science ed. program and that I need to be a science ed. person. It's just how it is. I'll take out what I can. Now, I guess I have more hope/drive that I can pursue closer to what I do.

Gayle: Build the things that you want to do into your program. Opportunities are there, you need to know what you want.

Jenna: I need to get more used to me being the driving force. A different way of seeing myself. I have to know myself more (03/13/2014).

Due to the occurrence of three critical instances within less than two weeks, the course of my thinking and reflecting shifted quite substantially. I began a process of re-discovery and identity development that focused on the components of being an environmental educator that transcend this field of practice to others I may engage in.

Finding ground in pedagogy

Data grouped under this category related to exploring the transferable elements of my EE identity to other fields of practice. Data within the category also contained questions relating to these connections as well as a plethora of broader questions about education at large.

In looking over the journal entries following the critical instances of weeks eight and nine, there was a great shift in the focus of the reflections. No longer were the reflections focused on who I was or trying to understand science and science education. Focus was instead placed on finding common elements that I strongly identified with in these fields (i.e. active/hands-on learning with reflections to one's own life). Several selected references from my journal are included below.

EE allows students to create their own value-system, make their own decisions about what they are experiencing. The organized chaotic atmosphere helps to push them into reflection. Reflective practices also are a lot more easily incorporated in EE than in the normal school-system, but that does not mean they can't be (Journal Entry, 03/24/2014).

[I] thought a lot more about the course I teach and comparisons with teaching outside. EE has a naturally built in component of student's making their own meaning out of what is being experienced. I think that is missing from a lot of more formal education. There needs to be more transformative experiences that really focus on reflection and meaning-making (Journal Entry, 04/07/2014).

I do think that there are components of EE that can be transferred into a more traditional school environment, should I find myself needing to work within that realm: these components relate to meaning-making and discovery learning (Journal Entry, 04/21/2014).

All of these reflections focus on pedagogy. I was describing the methods that I classify as essential and important to teaching and student learning. In seeing all of these connecting thoughts about pedagogy, I found myself not only analyzing the data from the last seven weeks of the study, but also going back and re-analyzing all of the previous data. This process again helped to reconfirm the findings already presented here, as well as helped to shed further light into an overarching connection that has been drawn throughout the entire study.

When reviewing the data for a second time, references to pedagogy could be seen as early as the second week of the study. Reflections indicated that the class went

well when it was less structured and student-guided (Journal Entry, 01/22/2014). My first exposure to the word “pedagogy” actually occurred during the first critical friends meeting. I even wrote that potentially the issue was not my identity, but more about determining my own pedagogy (Critical Friend Meeting, 01/23/2014). This embryonic idea of pedagogy being at the root of bridging these gaps I was exploring again appeared within the second critical friend meeting when I said:

I think a lot of this is turning into what I think education should look like. Yes, it [the study] is focused in the science realm, but I think that I feel the same way about all subjects. Education should be inquiry - meaning making (Critical Friend Meeting, 02/13/2014).

These thoughts continue to be extended in the following weeks when I directly indicate that EE and science education can be connected through the pedagogical traits of discovery learning, inquiry, and place-based learning (Journal Entry, 03/12/2014). A comment made during the third critical friend meeting is stated in a way that not only shows that connections I make with EE and science education, but more so to what I believe where education should be focused:

Students need to be given the time to reflect and make their own meaning and their own connections with what they are doing. This is not something that most can just do on their own, rather it needs to be purposefully facilitated and guided (Journal Entry, 03/24/2014).

This idea of making statements about my own views on education appears as the end of the semester is approaching as well:

[I] spent a lot of one-on-one time with the students today. I see the ones who have focus and internal motivation to either excel at school in order to get good grades or those that have a genuine interest in what they are doing. The latter have a sparkle in their eye the others do not. Then I see those who lack focus - they either entirely lack interest in the topic or cannot not find a way to connect to it. What about these students that “fall through the cracks?” Where is the time and the place for them to find what they need within the formal education system? Maybe I see more of an outlet for meaning-making and reflection in informal settings where EE thrives than the current formal educational system. Everyone (students and teachers) is spread so thin to meet what? The needs of the students? The needs of the system? The needs of the nation? What? (Journal Entry, 04/14/2014).

As indicated by the examples provided, this study focused on more than just my identity as an environmental educator and/or as a science educator. This study also focused on my identity as an educator in general. Through the exploration of myself within this situation I was able to begin questioning education as we know it and discover where I fit into the larger picture.

The second round of instructor evaluations showed an overall improvement in scores across the board. Highest marks were again found in communicating ideas and concepts confidently as well as demonstrating a thorough grasp of the course materials. Student comments continued to focus on needing more detail and explanations, but also included a great deal more positive comments relating to my overall teaching and ability as an instructor. By the end of the course in the third instructor evaluation, these positive comments further increased as well as the marks received for communicating ideas and understanding the material. While these evaluation results may correlate significantly with the relationship the students have to the course content during the period under evaluation, the added comments by the students do provide insight into my overall relationship and connection with the students in the course.

During the final week of the course I was teaching, my students had an evening of presentations focused on their own personal inquiry projects. Following the

evening's events, I took time to celebrate as well as to reflect on completing teaching another semester of the course as well as my first year as a science education doctoral student:

I ended the night feeling like I have found a place teaching this course here and being in this program, during this time. I still do not feel like this is my calling or my home in science education. My heart is rooted in changing and growing environmental values, interdependence with nature, and a belief that there is something greater than our own labels, definitions, and understandings that science provides us. However, just because I identify myself as an environmental educator does not mean that I cannot be a science educator as well. I can do both. Pedagogy can serve as the bridge that I have been looking for when I find myself in differing settings and fields of practice. I look forward to having the opportunity to continue to make incorporate reflection/meaning-making, and discovery/place-based into anything that I may be teaching. (Journal Entry, 05/07/2014)

In summation of the findings, three themes emerged that showed a progression of thoughts and ideas over the course of this study. Theme one focused heavily on exploring my own identity as an environmental educator in a science education world. Many of the journal entries involved making comparisons between the fields and trying to determine where and how I fit. Theme two provided insight into three critical instances that occurred over two weeks. These instances included the attendance at a science education symposium, a meeting with a professor outside the science education field, and an unstructured interview with a former supervisor and colleague. Solidification of my environmental educator identity could be seen after the three critical instances and a rising interest in focusing on ways to bridge the gaps when teaching in diverse fields. Theme three centered largely on making connections between my identities within various fields of practice. Defining my views on pedagogy was shown to be paramount to bridging these gaps. Further discussion of my pedagogical beliefs as they pertain to my identity as an educator and environmental educator working in diverse fields of practice as well as the implications of this study and line of research will be examined in the following section.

DISCUSSION AND IMPLICATIONS

Dewey (1916) explained that education is the "reconstruction or reorganization of experience which adds to the meaning of experience, and which increases ability to direct subsequent experience" (p. 76). Almost 100 years later, Dinkelman (2003) added to this idea by indicating that self-study can help promote the restructuring of ones' experiences through a more reflective teaching practice. The findings of this self-study fostered an understanding of my identity development as an educator, as well as ways to bridge the differences found when teaching in varying communities of practice. For the context of this study, I specifically focused on my value-centered identity (Sauvé, 2005) as an environmental educator within the science education realm and determined the overarching pedagogical connections that can bridge these fields together.

Results from the study clearly highlighted my strong connection and identity with environmental education, its interdisciplinary approaches towards addressing environmental issues, its value-based foundations and intent of individuals taking responsibility for their environmental actions (Hungerford, 2009; Ballantyne, 1996). As indicated in my findings, I came to realize that this identity does not have to be my sole identity. I also have an identity in other professional fields. Eshach (2007) describes ways in which EE can be connected to science education through

curriculum. These connections include: providing general learning experiences as well as new learning experiences for students, fostering interest and motivation, incorporating a change of setting or routine, promoting life-long learning, providing a means of enjoyment and reward for students, and satisfying school content demands. Brossard, Lewenstein and Bonney (2005) and Karrow and Fazio (2010) help to add more insight into connections between the fields. EE centers heavily on values, through awareness and understanding, these values are what help to engage students in finding ways to protect and preserve resources within their communities. Incorporating values-based discussions into science education curricula would help in facilitating the development of process and decision-making skills, as well as reaching higher levels of thinking and reasoning for the students. These are all desired skills within the science education field. After completing this exploration into my own science educator identity, I now see that values do not have to be excluded, but can and should be woven into the scientific discussion.

As Luehmann (2007) indicates, trying to identify within a community of practice outside of your own normal practice does involve some risks. Experiencing these “risks” initially led me into this self-study – questioning my identity, feeling unqualified, feelings of discomfort and internal conflict. My response to these feelings was to take the opportunity for my own personal development; this in turn would help me adjust to the changes in my professional growth by attending to my own feelings and concerns as I found myself in new and changing environments (Bell, 1998). Conclusions of the study led me to not only have a greater grounding in my identity as an environmental educator, but also in the pedagogical attributes that I identify with as an educator in general: discovery and place-based learning and inquiry. These attributes are another means of connection across fields. More specifically, they can act as the bridge that connects me to other communities of practice outside of environmental education.

Alexander (2001) explains that pedagogy consists of three underlying values that are then seen in the different methods with which an educator may employ. These values include:

- Individualism: choice, freedom of expression, self-actualization, rights over responsibilities, personal knowledge, differentiated learning, divergent outcomes, the individual.
- Community: respect for others, sharing, caring, the balance of responsibilities and rights, collaborative learning, the group.
- Collectivism: social cohesion, common ownership, shared values and norms, responsibilities before rights, joint learning, convergent outcomes, the class (pp. 520).

Alexander relates these as underlying values of pedagogy because they specifically refer to the relationship of teachers to their students and also to their communities. Many of the terms used in Alexander’s description were apparent throughout my exploration of teaching and identity as an educator. There were references to partaking in your own meaning-making, developing a value system, and working collaboratively through inquiry and discovery learning. These last two “attributes” of pedagogy, inquiry and discovery learning were highlighted throughout my journal entries as being methods to which I strongly relate.

As a result of an in-depth study on the identity development of student teachers, Eick (2002) concluded that exploring one’s personal history helps in the formation of a professional identity. I related well with one of the biology teachers in his study. This teacher noted that she was not able to learn through disconnected and unrelatable topics as she needed to see a bigger picture. She understood that she learned best through visualization and hands-on approaches. Many other researchers have suggested this idea of students being more drawn to actual, real-

life topics for over 50 years (Dewey, 1959; Smith, 2002). This idea of connecting education and learning to the environment with which a student is actively engaged in every day is the basis for place-based learning as defined by Sobel (2004). Place-based education focuses on using the local community and environment as a starting point to teach concepts in many different subject areas.

McCombs et al., 1991 stated that natural learning is active, internally mediated, a process where an individual constructs meaning from information and experience as it is filtered through their unique perceptions, thoughts, and feelings. Hammer (1997) further defined “natural learning” as discovery learning and indicated that discovery learning is designed to engage students in guided inquiry so they can, in a sense, discover the content on their own. Svinicki, (1998) adds to this definition by clarifying that the students are no longer passive recipients of information, but rather actively asking questions and making connections with their daily lives. These concepts can also be closely aligned with ideas of inquiry. Inquiry challenges the learning to identify their assumptions, to critically think and reflect using logical thinking, and to consider alternative explanations (NRC, 1996). Through inquiry-based learning students have more of an opportunity to interact with their peers in different environments (Anderson, 2007). LaBoskey (1997) states that reflection is not only a means for coming to know and understand something, but it also is a means for monitoring the moral and ethical ramifications of that knowledge. Reflections allow students to confront their own lived experiences, beliefs, fears, and misconceptions and how their lives connect within a particular field (Calabrese Barton, 1998).

This self-study not only helped me to clarify my identity as an environmental educator, but is also challenged my beliefs and ideas about education and pedagogical practices. I now have a much greater sense of my own beliefs in using discovery and place-based learning, reflection, and inquiry-based teaching to help bridge the differences between different communities of practice that I may find myself in throughout my life-time career as an educator. For any educator who must transition from one field of practice to another or even from one subject area to another, finding a common thread is critical. In finding this commonality, I was able to more easily merge into science education. I am an environmental educator at heart, but I am also an educator in the more general sense. It is my firm belief that all of these pedagogical methods should be used within education no matter the field of practice. Though I may still consider environmental education to be my primary identity, through the discovery of common threads, I now do identity as a science educator as well.

The intention of this study was not just for my own benefit, but also to contribute to other educator’s development as they find themselves transitioning into a new community of practice. One of the implications of this study for other educators is the importance of self-study, reflecting on ones’ own practice to enhance understanding and ones’ teaching. In many ways, self-study can aid teachers in the continual building of their self-efficacy as a teacher and as an expert in varying fields of practice. Teachers who have a higher self-efficacy in their field may be able to cross more easily into different fields of practice because they have a greater understanding of their own beliefs as well as confidence in their ability to influence student learning (Bandura, 1977). This idea can be applied to educators transitioning from two completely separate fields, like environmental and science education fields, or even from subject area to subject area within a curriculum. According to Bandura, having strong teaching self-efficacy beliefs is considered to be a valuable teacher characteristic.

Partaking in self-study not only helps to build and develop confidence as an effective teacher, but it also allows for teachers to have the ability to link and mitigate varying sources of experiences and knowledge (Luehmann, 2007).

Avraamidou (2014) emphasizes the value of exploring identities as a lens for examining teacher learning and development. As Varelas et al. (2005) concluded, creating a “hybrid” identity is an opportunity for teachers to build bridges connecting experiences and communities of practice. Bridges allow for easier navigation when transitioning and switching from different fields. With a greater understanding of a teacher’s varying identities there is greater likelihood for the discovery of specific pedagogical beliefs that transcend subject areas and fields and allow for a deeper understanding of teaching, teacher knowledge, student knowledge, and content knowledge.

REFERENCES

- Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education*, 27, 1-52. doi: 10.1080/03057269608560077
- Alexander, R. J. (2001). Border crossing: Towards a comparative pedagogy. *Comparative Education*, 37(4), 507-523. Retrieved from <http://www.jstor.org/stable/3099559>
- Anderson, R. (2007). Inquiry as an organizing theme for science curricula. In S. Abell and N. Lederman (Eds.), *Handbook of Research on Science Education* (pp. 807-830). Oxford, England: Routledge Publishers, Taylor and Francis Group.
- Avraamidou, L. (2014). Studying science teacher identity: Current insights and future research directions. *Studies in Science Education*, 50(2), 145-179. doi:10.1080/03057267.2014.937171
- Ballantyne, R. & Packer, J. (1996). Teaching and learning in environmental education: Developing environmental concepts. *Journal of Environmental Education*, 27(2), 25-32. doi: 10.1080/00958964.1996.9941455
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
- Bell, B. (1998). Teacher development in science education. In B. J. Fraser & K. G. Tobin (Eds.), *International handbook of science education*. Dordrecht: Kluwer Academic.
- Berry, M., & Russell, T. (2014). Critical friends, collaborators and community in self-study. *Studying Teacher Education*, 10(3), 195-196. doi: 10.1080/17425964.2014.958283
- Brickhouse, N., Lowery, P., & Schultz, K. (2000). What kind of a girl does science? The construction of school science identities. *Journal of Research in Science Teaching*, 37(5), 441- 458. doi: 10.1002/(SICI)1098-2736(200005)
- Brossard, D., Lewenstein, B., & Bonney, R. (2005). Scientific knowledge and attitude change: The impact of a citizen science project. *International Journal of Science Education*, 27(9), 1099-1121. doi: 10.1080/09500690500069483
- Bullough, R., & Pinnegar, S. (2001). Guidelines for quality in autobiographical forms of self-study research. *Educational Researcher*, 30(3), 13-21. Retrieved from <http://www.jstor.org/stable/3594469>
- Calabrese Barton, A. (1998). *Feminist science education*. New York: Teachers College Press.
- Cochran-Smith, M. & Lytle, S. (1999). Relationships of knowledge and practice: Teacher learning in communities. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (Vol. 24, pp. 249-305). Washington, D.C.: American Education Research Association.
- Coleman, E., & Leider, M. (2014). Personal and professional growth realized: A self-study of curriculum design and implementation in a secondary science classroom. *Studying Teacher Education*, 10(1), 53-69. doi: 10.1080/17425964.2013.835260
- Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative sociology*, 13(1), 3-21.
- Day, C., Kington, A. and Gu, Q. (2005) *The role of identity in variations in teachers' work, lives and Effectiveness*. Paper presented at ESRC Seminar Series University of Nottingham.
- Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York: Free Press.
- Dewey, J. (1959) School and Society. In M. Dworkin (Ed.), *Dewey on Education* (pp. 76-78). New York: Teachers College Press.

- Dinkelman, T. (2003). Self-study in teacher education: A means and ends tool for promoting reflective teaching. *Journal of Teacher Education*, 54(1), 6-18. doi: 10.1177/0022487102238654
- Eick, C. J. (2002). What makes an inquiry-oriented science teacher? The influence of learning histories on student teacher role identity and practice. *Science Education*, 86(3), 401-416. doi: 10.1002/sce.10020
- Eshach, H. (2007). Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. *Journal of Science Education and Technology*, 16(2), 171-190. Retrieved from <http://www.jstor.org/stable/40188686>
- Gee, J. P. (2005). *An introduction to discourse analysis: Theory and method* (2nd ed.). New York: Routledge.
- Gough, A. (2002). Mutualism: a different agenda for environmental and science education. *International Journal of Science Education*, 24(11), 1201-1215.
- Hammer, D. 1997. Discovery learning and discovery teaching. *Cognition and Instruction*, 15(4), 485-529. Retrieved from <http://www.jstor.org/stable/3233776>
- Hart, P. (2007). Environmental Education. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 1105-1149). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc., Publishers.
- Hungerford, H. (2009). Environmental education (EE) for the 21st century: Where have we been? Where are we now? Where are we headed? *The Journal of Environmental Education*, 41(1), 1-6. doi: 10.1080/00958960903206773
- Karrow, D., & Fazio, X. (2010). Educating-within-place: Care, citizen science, and ecojustice. In D. J. Tippins, M. P. Mueller, M. van Eijck & J. D. Adams (Eds.), *Cultural studies and environmentalism* (pp. 193-214). Springer Netherlands.
- LaBoskey, V. K. (1997). Teaching to teach with purpose and passion: Pedagogy for reflective practice. In J. Loughran & T. Russell, *Teaching about teaching: Purpose, passion, and pedagogy in teacher education*, (pp. 150-163). Routledge: London.
- LaBoskey, V. K. (2004). The methodology of self-study and its theoretical underpinnings. In *International handbook of self-study of teaching and teacher education practices* (pp. 817-869). Springer Netherlands.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.
- Leavitt, R. (1995). Language and cultural content in Native education. In M. Battiste & J. Barman (Eds.), *First Nations education in Canada: The circle unfolds* (pp. 124-138). Vancouver, Canada: University of British Columbia Press.
- Lederman, N.G. (2010). Nature of science: Past, present, and future. In S.K. Abell and N. G. Lederman (Eds) *Handbook of Research on Science Education*, (pp. 831-880). Mahwah, NJ: Erlbaum.
- Lemke, J. L. (2003, April). *Identity, development, and desire: Critical questions*. Paper presented at the meeting of the American Educational Research Association, Chicago, IL.
- Lighthall, F. F. (2004). Fundamental features and approaches of the s-step enterprise. In J. J. Loughran, M. L. Hamilton, V. K. LaBoskey, & T. Russell (Eds.), *International handbook of self-study of teaching and teacher education practices* (pp. 193-246). Dordrecht: Kluwer.
- Loughran, J., & Northfield, J. (1998). A framework for the development of self-study practice. In M. L. Hamilton, S. Pinnegar, T. Russell, J. Loughran, & V. LaBoskey (Eds.), *Reconceptualizing teaching practice: Self-study in teacher education* (pp. 7-18). Bristol, Pennsylvania: Falmer Press.
- Luehmann, A. L. (2007). Identity development as a lens to science teacher preparation. *Science Education*, 91(5), 822-839. doi: 10.1002/sce.20209
- Luft, J. & Roehrig, G. (2007). Capturing science teachers' epistemological beliefs: The development of the teacher beliefs interview. *Electronic Journal of Science Education*, 11(2). Retrieved from <http://ejse.southwestern.edu>.
- McCombs, B., Berliner, D., Ilutkins, C., Jones, B., O'Neil, H., Mills, R.,...& Wittcock, M. (1991). *Learner-centered psychological principles: Guidelines for school redesign and reform*. Washington, DC: APA Task Force on Psychology in Education.
- National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.

- Pinnegar, S., & Hamilton, M. L. (2009). *Self-study of practice as a genre of qualitative research*. Dordrecht, Netherlands: Springer.
- Saka, Y., Southerland, S. A., Kittleson, J., & Hutner, T. (2013). Understanding the induction of a science teacher: The interaction of identity and context. *Research in Science Education*, 43(3), 1221-1244. doi: 10.1007/s11165-012-9310-5
- Sauvé, L. (2005). Currents in environmental education: Mapping a complex and evolving. *Canadian Journal of Environmental Education*, 10(1), pp-11.
- Settlage, J., Southerland, S. A., Smith, L. K., & Ceglie, R. (2009). Constructing a doubt-free teaching self – self-efficacy, teacher identity, and science instruction within diverse settings. *Journal of Research in Science Teaching*, 46(1), 102-125. doi: 10.1002/tea.20268
- Smith, G. (2002). Place-based education: Learning to be where we are. *Phi Delta Kappan*, 83(8), 584-594.
- Sobel, D. (2004). Place-based education: Connecting classroom and community. *Nature and Listening*, 4. Retrieved from <http://www.antiochne.edu/wp-content/uploads/2012/08/pbexcerpt.pdf>
- Stapp, W. B. (1969). The concept of environmental education. *Journal of Environmental Education*, 1(1), 30-31. doi: 10.1080/00139254.1969.10801479
- Svinicki, M. 1998. A theoretical foundation for discovery learning. *American Journal of Physiology*, 275(6), 4-7. Retrieved from <http://elmu.umm.ac.id/file.php/1/jurnal/A/Advances%20in%20Physiology%20Education/Vol275.Issue6/S4.pdf>
- Varelas, M., House, R., and Wenzel, S. (2005). Beginning teachers immersed into science: Scientist and science teacher identities. *Science Education*, 89(3), 492-516. doi: 10.1002/sce.20047
- Weibke, H. & Park Rogers, M. (2014) Transition to science teacher educator: Tensions experienced while learning to teach lesson sequencing. *Studying Teacher Education*, 10(3), 222-238. doi:10.1080/17425964.2014.949657
- Wenger, E. (2011). *Communities of practice: A brief introduction*. Retrieved from <https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/11736/A%20brief%20introduction%20to%20CoP.pdf?sequence=1>
- Williams, J., Ritter, J., & Bullock, S. (2012). Understanding the complexity of becoming a teacher educator: Experience, belonging, and practice within a professional learning community. *Studying Teacher Education*, 8(3), 245-260.
- Zembylas, M. (2003). Interrogating “teacher identity”: Emotion, resistance, and self-formation. *Educational Theory*, 53(1), 107-127. doi: 10.1111/j.1741-5446.2003.00107.x

