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Content versus Process: The Lifeworld Construction of a Science Teaching Identity

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ABSTRACT

Research-based science curriculum has become a common means of supporting best practices in science teaching. However, despite one elementary school's adoption of commercially available science curriculum, the school's fifth-grade teacher selected only certain science modules for implementation in her classroom. The purpose of this narrative study is to understand how this teacher's science pedagogy has been shaped through her lifeworld experiences with science, and in what ways these experiences informed her selection of topics from the school's chosen science curriculum. The pedagogy that guided this teacher's curricular decision situated her construction of a science teaching identity in both personal and professional spaces, with the former stemming from past, present, and anticipated experiences with science. This identity construct established tension around specific domains of the curriculum's science content, not the inquiry-based teaching practices prescribed therein. The conflict resulted in the selective use of a curriculum reflective of the teacher's lifeworld experiences with science. Therefore, the construction of a science teaching identity that relies on both personal and professional contexts, and considers experiences with science across time, offers deepened insight into teachers' use of reform-based science teaching practices.

Keywords: *science, lifeworld, identity, narrative, inquiry, curriculum*

Introduction

Commercially produced, inquiry-based science curriculum has become increasingly relied upon to ensure best practices in science teaching. Following the district's recommendation, a partnering elementary school adopted the district's endorsed scope and sequence compiled from such available science curriculum. While most teachers in this school either accepted or rejected this science curriculum, the school's self-contained fifth-grade teacher, Ms. Terri (a pseudonym), utilized a more selective approach. Among the four science modules designated for fifth-grade, she chose to implement only two of them, replacing the remaining two modules with curriculum she designed herself. This raised several questions. For instance, given a similar emphasis on inquiry practices across these modules, what led Ms. Terri to use one science kit and not another? How might such a decision reflect her self-understanding as a science teacher, as well as Ms. Terri's understanding of her students as science learners? Finally, how does her selective use of these science modules relate to her own experiences with science?

The purpose of this empirical case study is to understand Ms. Terri's perceptions of the school's adopted science curriculum, her self-designed units, and how these perceptions relate to her experiences with science over time. It is these perceptions that frame her broader pedagogical stance

and establish a science teaching identity that informs her response to the materials and methods of science education reform.

In addition to understanding Ms. Terri's discerning curricular decisions, the intent behind focusing upon her stories is to establish the construction of a science teaching identity that relies on prominent teacher voice through focused inclusion of her narratives (Ritchie, 2009). Previous single-participant studies, which report on research about teacher identity, have offered deep insight into science teaching practices (Avraamidou, 2014a; Upadhyay, 2009). Ms. Terri's narratives do so as well while contributing toward the need to further connect science teacher identity research to reform initiatives (Avraamidou, 2014b).

Ms. Terri's narratives situate science teaching in a pedagogical expression of what she values rather than resistance to a curricular change and its associated science teaching practices. This sense of value impacts how science is pursued in her classroom, yet it is her personal experiences with science that further inform her formulation of a science teaching identity. These experiences are not solely situated in Ms. Terri's past. They inform her present curiosities and her future ambitions, formulating a science teaching identity embodying not just professional but personal interests sustained across time. Therefore, when attempting to further teachers' use of the practices of science education reform, Ms. Terri's narratives suggest a consideration of the subject matter being taught relative to the practices utilized to teach it, given the value-laden interests in both.

Literature Review

Situating Identity within Science Education Reform

Current reform literature advocates for the teaching and learning of science through inquiry, whereby students engage in scientific practices to develop their understanding of science (Miller, Manz, & Russ, 2018; National Research Council, 2012). Thus, teachers are being asked to unify their instructional methods in the name of a standards-based science education emphasizing inquiry. Reform-based materials are one means of offering teachers the support needed to implement these teaching strategies (Eick & Stewart, 2010). Yet research recognizes that reform efforts and their associated curricula face resistance from teachers (Irez & Han, 2011). Thus, progress toward widespread, inquiry-based science instruction remains slow while teacher-centered practices that emphasize transmission of knowledge and rote memorization persist (Kazempour & Amirshokoohi, 2014).

Reform efforts have acknowledged the pivotal role teachers play in achieving the goals of science education reform (Cook, Walker, Weaver, & Sorge, 2015). As a result, it has become necessary to consider how teachers' backgrounds inform their pedagogical content knowledge and pedagogical thinking (Park, Jang, Chen, & Jung, 2011; Schneider, 2013). This includes teachers' memories of learning science, which inform their instructional approaches and contribute toward their development as science teachers (Carrier, Whitehead, Walkowiak, Luginbuhl, & Thomson, 2017; Dickson & Kadbey, 2014). Indeed, an examination of teacher identity, their instructional decisions, and broader pedagogical beliefs offers insight into science teaching practices (Enyedy, Goldberg, & Welsh, 2006). Thus, constructs of teacher identity have emerged as a multidimensional lens to explore the ways in which individuals see themselves as science teachers and how those understandings inform practice (Avraamidou, 2016).

Conceptualizing Identity Across Time

A hermeneutic view of identity, which recognizes the import of experiences across time, offers a theoretical framework for expanding upon understandings of teachers' experiences with science and their impact on teaching practices. A hermeneutic perspective on identity relies on experiences that originate in the past, orient us in the present, and continue to direct us toward the future. Attention to experiences across time offers a more holistic understanding of the interests and beliefs that inform science teaching practices.

A hermeneutic perspective on identity begins with the acknowledgement that in our knowledge constructions are presuppositions that inform our views on experiential possibility (Husserl, 1907/1999). These might include opportunities a teacher sees within the context of teaching reform-based science. We draw our presumptions from the lifeworld in which we are embedded. This is created through our involvement with everyday activities and the people and relationships therein that constitute one's world (Schwandt, 2015). Here the initial focus is on those experiences that are more immediate and pre-reflexive as opposed to the circumstances that would allow us to organize and reflect on them (Schutz & Luckman, 1973/1980).

However, one's past experiences gather significance through memory of and reflection upon them (Heidegger, 1927/1962). Of relevance here is a teacher's personal history as a science learner, in addition to experiences teaching science. Together they play an integral role in science teaching identity development (Eick & Reed, 2002; Volkmann & Zgagacz, 2004). This formulates the tacit knowledge and personal judgments used to make sense of teaching science (Schwandt, 2015). In the lifeworld, a world concerned with the everyday events in life, the negotiation of these experiences and their ensuing presuppositions are common (Van Manen, 2016).

Gadamer (1960/1994) labeled these perceptions "prejudices" and situated them within the horizon of our present understanding. These prejudgments allow our previous experiences to orient us toward life in certain ways, allowing for reliable preconceptions that make unfamiliar situations familiar, and thereby permit the past to play a role in the present (Gallagher, 1992). Despite their negative connotation, our prejudices allow us to determine which encounters limit us, and which are enabling, rebuilding practices in an open and ever-changing manner (Bernstein, 1983). These form the perceptions that shape teachers' orientations toward school science as they consider teaching it and construct their science teaching identities (Guzey & Ring-Whalen, 2018). A teacher's professional knowledge, the curriculum's subject matter, and the teaching environment can inform this identity (Proweller & Mitchener, 2004). It is also informed by personal teaching philosophies that affect one's understanding of students' needs and interests (Hsu, Reis, & Monarrez, 2017).

However, as Bernstein (1983) pointed out, a third component of these perceptions is their progressive nature. In other words, there is a connection between our past experiences and present activities in light of what we will undertake in the future. This type of projection is value-laden, underlying the type of life one believes to be meaningful (Taylor, 1989). In her work with secondary science teachers, Helms (1998) explicated that this orientation toward the future, as reflected in an affinity for teaching certain science subject matter, attends to a science teaching identity beyond the professional. Since it encompasses teachers' beliefs about what makes science meaningful and valuable, a science teaching identity establishes connections between how teachers view themselves as people and educators, as well as how they perceive science. Therefore, a science teaching identity illustrates what teachers want to become in their professional and personal lives and impacts how science teaching is approached in the classroom. This includes interests that guide teachers into the future and more broadly reflect their sense of identity, linking it to who they are and positioning it not just in the present but in the anticipation of future events within vocational and personal spaces (Taylor, 1991).

Thus, the understandings teachers use to conceptualize teaching science reveal certain implicit self-understandings as well. These understandings are situated amid their position teaching science inside the classroom and experiencing science outside of it. A description of how these experiences inform one another illustrates what teachers value within the context of science education reform amid their views on teaching and learning (Taylor, 1994).

Methodology

Narrative

This is a study in narrative. According to Widdershoven (1993) it is through narrative that the implicit meanings of life are made explicit. This perspective recognizes the base, or pre-reflective source, of Ms. Terri's stories as life and lived experience. The application of her narratives depends upon their relationship to life. Therefore, when Ms. Terri recounted past experiences, she clarified what they meant and connected them to other experiences learning science, more recent experiences teaching science, and future situations connected to science. The work of Ricoeur (1985/1988) further establishes a narrative relationship to identity, with identity being the narrative construction of this reflective process (Ezzy, 1998). Thus, it is important to acknowledge both the lived and told nature of these stories (Fay, 1996). This approach offered Ms. Terri a sense of agency since the narratives she selected to tell and how she chose to tell them are both aspects of her identity construction.

At times the use of the term "narrative" can be ambiguous, encompassing multiple meanings (Riessman, 2012). In part, the use of the term refers to Ms. Terri's life stories, through which the qualities of her life surrounding the learning and teaching of science were explored (Denzin, 2014). These include more expansive time frames such as her schooling experiences. Ms. Terri's life stories helped situate her personal experiences narratives about specific events learning and teaching science, imbued with her values and beliefs regarding those experiences (Denzin, 2014). Together, these two types of narrative formed self-stories. Self-stories dealt with broader and more specific elements simultaneously, whereby Ms. Terri's interpretations addressed the events and their influential nature, as well as the self (Denzin, 2001). Therefore, her narratives are part of a reflective process that unified Ms. Terri's experiences and her thoughts on those experiences around a single reference point – science education (Denzin, 2001).

Data Collection

Ms. Terri's stories were drawn from a larger study on teachers' perceptions of science education reform and their school's use of research-based science curriculum. The intent was to uncover how the teachers' perceptions reflected their broader understandings of teaching and learning science. The summer following her first year implementing the school's adopted science curriculum, Ms. Terri participated in six semi-structured, audio-recorded interviews lasting around two hours each. Individual interviews took place approximately two weeks apart in order to support ongoing data analysis (Bogdan & Biklen, 2006).

Ms. Terri's interviews were planned with several narrative points in mind. Given the substantive nature of the research focus, interview questions asked her to structure life stories around topics that emerged as the conversations unfolded. These stories addressed particular facets of her life that she deemed relevant to her perceptions of teaching and learning science (Wallace, 1994). Ms. Terri's extensive accounts situated more detailed experiential narratives surrounding these events, thereby making the relevance of her storytelling clear on her own terms (Polanyi, 1985). Thus, whenever Ms. Terri generalized, she was encouraged to recount narratives about experiences that

embodied those abstractions and demonstrate how their meaning emerged through experience (Holstein & Gubrium, 1995).

Analysis

Analysis of Ms. Terri's narratives was ongoing in that it constituted part of data collection that aided in analysis after leaving the field (Bogdan & Biklen, 2006). In-the-field analysis included listening to the audio-recorded interviews and reading the transcripts in order to identify emerging themes. Emergent themes were personally noted given their grounding in the data, connection to the studies wider context, and thus based on their potential to establish more formalized connections among the data (Williams, 2008). Further, these interpretations and conclusions were discussed with Ms. Terri, allowing her space to react and interact with those ideas (Lincoln & Guba, 1985). With the use of in-the-field analysis, data collection sessions were planned in light of what happened in previous meetings.

Post-field analysis involved an open-ended examination of Ms. Terri's transcribed narratives (Rossman & Rallis, 2012). First, her narratives were analyzed thematically in order to reveal their meaning (Riessman, 2012). In this manner themes surrounding Ms. Terri's affinity for certain science content, and how this not only informed her curricular decisions but a broader science teaching pedagogy, were uncovered to establish their meaning within the context of her narratives. Following Coffey & Atkinson (1996), the themes were used to explore how Ms. Terri framed and made sense of particular sets of experiences with the themes acknowledged as providing insight into her understandings of those events. Thus, focusing on themes was meant to capture the detail of her experiences teaching and learning science and reveal the individuality of Ms. Terri's science teaching identity (Cole & Knowles, 1995). These themes also constituted analytic points of departure from which data were reread and explored in more detail with attention paid to the descriptions of events and happenings central in Ms. Terri's experiences. This furthered an understanding of how she framed and made sense of these experiences and helped establish the perceptions central to Ms. Terri's construction of a science teaching identity. From both readings of the data the storyline within and between her narratives was found, which offered them greater coherence (Brinkman & Kvale, 2015). Thus, Ms. Terri's narratives were analyzed around themes that offered unity and organized her individual narratives into a richer, more condensed account.

Results

Background

The daughter of a stay-at-home mother and father who owned a scrap metal business, Ms. Terri grew up in a suburb adjacent to the city in which she teaches. She explained, "I lived a nice life," in reference to her family's financial security. This allowed Ms. Terri to dedicate her time during the week to school, friends, and household chores that earned her an allowance. Weekends were spent visiting friends and extended family in the area.

Ms. Terri's background also influenced those early activities that led to her interest in teaching. She described her desire to teach, in part, as stemming from her organization of summer playgroups that began when she was 12 years old. Here she arranged a morning play school for neighborhood children where she structured activities, offered organized outdoor play, and provided snacks. Ms. Terri recalled possessing the ability to engage the children and focus their attention. In addition to her fondness for working with children, she remembered limited professional opportunities that also influenced her decision to begin a teaching career. As she put it, "When I was getting closer and closer

to college, and in my generation, it was either become a nurse or become a teacher, because the thought was that you would get married and be out of teaching."

Thus, Ms. Terri enrolled in a local university, pursued education coursework, and, prior to student teaching, married. After marrying, she did not abandon her pursuit of a teaching degree and credentials. Eventually, Ms. Terri student taught in a kindergarten, first, and second grade classroom over the course of a twenty-four week trimester. Once she completed student teaching, Ms. Terri obtained her first teaching position in a school located within the city's large public school district.

Though it was early in her teaching career, Ms. Terri's first job proved to be a professional turning point. She taught in a school with a predominantly African American student body and gender-divided classrooms, inclusive of students with special needs. This population of students and classroom structure sharply contrasted with the white, middle- to upper-class students she experienced as a student teacher. Moreover, as a new teacher, the behavior and management issues that surfaced in what Ms. Terri described as a physically aggressive, all-male classroom made instruction a challenge. This inspired doubt in her ability and desire to continue teaching. Ms. Terri said, "There were some times when I went home crying, saying, 'I can't do this, I don't want to do this anymore! I need to quit!'" Nevertheless, Ms. Terri remained at the school for the first few years of her teaching career, which she considered emblematic of her commitment to teaching.

Ms. Terri further believed that her 33-year career as a full-time, public school teacher reflected a sense of determination and commitment. Although she has taught in five different schools, all of them have been located within the same large, urban school district.

Fascination with Certain Science Content

Once Ms. Terri began discussing her early experiences learning science, she recalled her elementary school's use of a structured curriculum. As with the other content areas, Ms. Terri remembered that throughout elementary school her teachers relied upon these curriculum guides for their science instruction. She discussed the use of these guides and her initial experiences with school science, incorporating examples of projects she conducted. One such project centered on the study of birds during the third grade:

> In particular I remember one about birds. She taught us a whole unit on birds. And so, there were lots of lessons learning about birds, their mating, their nests, we learned all about their nests, birds in different regions in the country. And then we had to do this project and we had to pick two or three different birds and she gave us an outline of how she wanted it to get done. And of course, the more information you put down, the better your grade and the more pictures you got in, whether they were hand-drawn or cut out from a book or a magazine. And so, my parents had bought the World Book Encyclopedia and I went in and I cut out pictures of birds from the World Book Encyclopedia! So, grammar school, you know, whatever we had to do in science it was fine! Anything to do with animals or weather, or rocks, plants and growing things.

Ms. Terri offered this account as one representation of what she enjoyed about science during elementary school. In doing so, she qualified that her regard for certain science topics she learned in school was based on an inherent interest in the subject matter: "If I was interested in the particular subject that was being taught I was fine. If I wasn't interested, I was off in la-la land and could care less."

A genuine interest in science has been established as an important part of scientific literacy and thus an overall goal for science education (Swarat, Ortony, & Revelle, 2012). In order to advance this aim, efforts have been made to identify science topics perceived as interesting (Baram-Tsabari & Yarden, 2005; Dawson, 2000), much like those Ms. Terri listed, only to find this inherent interest weaken depending on how science is taught (Krajcik, Czerniak, & Berger, 2003). Yet Ms. Terri's selective interests in science did not diminish. Rather, it was increasingly emphasized across her narratives about her past scientific pursuits and her present connections to science.

Ms. Terri only remembered fragments of her science education through middle and high school, such as dissecting in labs and memorizing formulas. These topics did not hold her attention; thus, she did not put much effort toward engaging with them. As a result, Ms. Terri's success in science declined. However, she described the latter part of high school as a turning point. Renewed feelings of success in science were attributable to an interest in earth science, particularly the subject of weather. This subsequently informed the science courses Ms. Terri chose as a college student:

> I remember in a college course I took, I don't know if that was under the, you know, the topic of earth science, I think it was. And for a week we got to go, in this particular class, we got to go to the airport and go to their weather tower. We watched them with, I don't know if it was called the Doppler radar at that point, but we got to watch this and see everything that went on, on a daily basis. And that really got me into talking about and liking anything that has to do with weather.

The import of this past narrative account emerged in the broader meanings it elicited for Ms. Terri, which portrayed her study of weather as more than a simple curiosity or interest:

> Yeah, and you have to remember that weather was something that I was extremely interested in. I just would sit in amazement watching those weather patterns going through and it's like, amazement. I don't want to repeat myself, because, you know, if it's a subject that interests me and intrigues me if I'm fascinated by it, it's like I want to learn everything I can, be there to witness it, I'm right there. It's like, hurricanes, oh my gosh, I could just sit and watch the weather channel, especially when they have, when there is a hurricane coming in.

In this more recent memory, the language Ms. Terri used to express her past involvement with science intensified. She moved from naming it as an interest to invoking associated feelings of amazement, intrigue, and fascination. In her discussion, one can also see a transition from that past experience of studying the weather at an airport to the present with its more implicit self-understandings. Here, Ms. Terri named herself as one who wants to learn about and experience these phenomena. Therefore, it is against the backdrop of this science content that these tastes and desires become accessible and contribute to the construction of a personal identity (Taylor, 1994). Moreover, it begins to establish Ms. Terri's agency as a learner influenced by how science is pursued, the materials and methods used, and her own choices (Brickhouse, 2001; Brickhouse, Lowery, & Schultz, 2000). Her present experiences with this science subject matter further show how her sustained involvement with it has contributed toward her identity.

Prior to continuing the discussion on her encounters with science, a severe storm moved through the area with strong winds and heavy rain, lightning and loud thunder. Eventually sirens indicated a tornado warning. Ms. Terri was eager to discuss this weather event and shared where she was and what she saw as this storm moved through the area:

> I was driving home yesterday afternoon and I was on the expressway going north. And just when I hit Willow Road I could see to the south and the west it was sort of brighter. But as I was going north, the sky was pitch black and there were bolts of lightning coming across the sky. Now this was about 2:30 in the afternoon! And I'm driving and I'm just like fascinated by this! I'm just like, fascinated!

Ms. Terri continued to describe this event with fascination while simultaneously situating it in a present observational experience. This narrative led to discussion of her more routine observational practices:

> A lot of times I'll just sit on my balcony because I have an overhang. And I watch the storms move in and I just sit out there and watch the movement and the lightning. It's just something that intrigues me, it's like you never can get enough of that, at least for me. I'm the type of person where if I see the bolt of lightning I do the counting, like you count to ten and you hear the thunder!

Although Ms. Terri spoke of other activities that she performed related to science, they did not indicate this experiential frequency or consistency. Thus, Ms. Terri established a sense of engaged agency (Taylor, 1995) across these repeated experiences. In other words, Ms. Terri introduced a coherence or unity of experiences where we find her open to examining the movement of these storms and their production of lightning. The nature of these experiences, as reflected in her description of counting the seconds between the thunder and lightning to approximate the storm's distance, indicates an effort to understand them, to make the storm comprehensible. Experiencing her world in this way, Ms. Terri continued to invoke particular self-understandings as she asserted herself as the type of person that participates in those practices. As a consequence, she maintained an identity that continued to define her relative to weather-related phenomena (Taylor, 1994). In this case, Ms. Terri uses recurrent practices of observation and estimation to make sense of a storm and its production of lightning.

After Ms. Terri articulated those recurring practices, she was asked once again to recall her past experiences in order to uncover the possibility of a defining moment or experience that founded her fascination with weather:

> I actually have been in a few sand storms in Arizona, and that's an extremely frightening experience because sometimes the winds pick up the sand and twirls it around where it almost looks like a tornado. I have been caught in a couple of those. I've been in a few major storms out on a cruise ship, and that's a very scary thing! But I've never been in a tornado and I have never been anywhere close to a hurricane. I would love to be. Well, not when the hurricane comes in, but when the hurricane winds come in and the waves are getting really choppy, I would like to be on the beach at that time. A couple days before the hurricane just to see what it feels like. You see pictures of it but I want to see what it feels like.

While reflecting on her past encounters with those storms, she returned to the present, naming unfulfilled experiences, and projected into the future where certain aspirations were made explicit. Her ongoing discussion of a project allowing her to fulfill those aspirations and maintain an

interconnection of experiences and values, sustained Ms. Terri's identity in this way of being in the world (Van Manen, 2016):

> And it's funny, because on my sixtieth birthday one of my presents to myself will be, I'd like to go on one of those storm chaser trips. Probably the summer after I retire. Because to me, I'm fascinated by hurricanes, I'm fascinated by tornadoes, I'm just fascinated by all this stuff.

Selective Use of Science Curriculum

Ms. Terri was introduced to the school's adopted science curriculum when she entered her classroom and saw the boxes containing four units designated for fifth-grade. Among those modules she eventually implemented were a solar energy unit investigating the positioning of the sun, the sun as an energy source, and solar energy transfer and a time measurement unit relying on the movement of the sun and moon to track time. Additionally, there was a a simple machines unit exploring the concepts of force, work, and how simple machines make work easier and a microorganism unit using different magnifiers to explore everyday objects and live specimens that she excluded. Prior to her selective use of the science curriculum Ms. Terri was overwhelmed with the prospect of teaching four modules over the course of a single school year. This stemmed from the quantity of materials the curriculum supplied, the lesson plans needing her review, and her understanding of the subject matter:

> Well, when you first get the boxes they are very overwhelming. You can't go through the teacher's guide at one sitting. You have to read the overview and then you have to read lesson to lesson until you get it, you're comfortable with it. I think the first one was micro-worlds for fifth grade. Overwhelmed! Just totally overwhelmed, and then that one you had to set up, it came with microscopes and you set up the microscopes for the kids and everything. And when you're not that proficient in the subject area yourself, it's even more difficult to teach it to the children.

However, Ms. Terri eventually participated in the in-services offered in conjunction with each curricular unit. One session she recalled included a day spent investigating the solar energy module and the practices and procedures it entailed:

> We did a whole day on the solar energy unit and I loved it! The first thing we did is we came out in the morning and you had a partner. We were doing shadows and how shadows get smaller as you get closer to noon and as you get around sunset the shadows get larger again. And we had to take chalk and draw the difference in our shadows, and that was great! That was so interesting! I mean, here we are a group of adults and we could have been as unfocused as students. And then we took thermometers and stuck them in the water; we actually had heat lamps that I know is very difficult for them to bring in, and measured the change in temperatures every five minutes. I mean, that was great! We had someone who knows everything about the kit and what you can do with it show us. I think that's extremely important.

Here she expressed enthusiasm for the curriculum's engaging and investigative nature. Moreover, Ms. Terri valued the opportunity to partake in the same inquiries her students would eventually conduct. Thus, she participated in the scientific investigations and thinking that are a necessary component of

establishing a broader appreciation for reform-based practices (Luehmann, 2007). This greater appreciation was reflected in her overall approval of the science's curriculum's exploratory practices:

> Well, now that I know it's about the kits as far as science goes, I love it. It makes everything so much easier and clearer. You know what to, where to go and how much to do. It gives ideas about how to do experiments; it gives children a lot of exploring time to see what they find out. So, I think it builds up a lot of team effort plus independent thinking and making predictions and inferring.

Yet when Ms. Terri discussed teaching the solar energy investigation on shadows in her classroom, she qualified her interests in the science curriculum relative to the content pursued:

> We had to do it in the morning; there was no doubt about it. We had first period, get the kids settled in, and then took them outside right then and there. After we got outside they traced their first shadow, waited five to ten minutes, traced it again, and they could see how the shadow changed. And then, they predicted, they realized that the shadows would get shorter again! The unit on the solar energy, it's something that I have an interest in. The planets always intrigue me, the sun and the moon, how they affect the weather, all that stuff. So again, that's something that I watched the students do very closely and I was interested in all of the experiments that they did and how they pulled that big unit together.

The solar energy curriculum established an overlap between Ms. Terri's personal and professional identities given a perceived connection to weather-related content. This content fostered her construction of an identity encompassing certain personal qualities and reflected her agency as a learner within a way of being in the world (Taylor, 1995; Van Manen, 2016). Therefore, Ms. Terri's sense of agency made her attention to teaching this unit a familiar project and established a science teaching identity inclusive of her personal qualities (Gallagher, 1992). Ms. Terri further illustrated the importance of this personal and professional overlap when she discussed the microorganism module she elected not teach:

> Yeah, because when I'm interested in the topic I can't do enough, okay? If it's something that I'm not, like microorganisms, not one of my favorite subjects. So, did I give it my whole, you know, self to get it done? No, I probably did not.

Expression of a Science Teaching Pedagogy

Ms. Terri's diminished attention to teaching the microorganism unit maintained a consistency between values and actions that created tension amid personal self-interests and professional responsibility (Ramezanzadeh, Zareian, Adel, & Ramezanzadeh, 2017). While this continued to affirm her way of being in the world, it also indicated science content that lacked meaning therein. However, in her discussion of the microorganism unit Ms. Terri further situated her instructional preferences in the construction of a science teaching identity when it emerged as an expression of her science teaching pedagogy (Enyedy et al., 2006):

> I think that the weather is important for the kids to know and learn about. You can't even imagine how many kids come in, they don't know the four seasons! Believe it or not! They

> don't know the four seasons! I remember learning all of that stuff. I remember learning that the first day of summer is June 21st and the first day of fall is September 21st, and so on and so forth. A lot of students have no idea about the changing of the colors that starts happening in the fall. They don't know that! I feel like I need to teach it to them because the things that I grew up learning, I want them to learn. Because I think that some of the stuff that I've learned and the way my teachers taught it were interesting. I think some of the stuff that they have in the standards and the framework, you know, are they going to use it in their everyday life? Probably not. OK? Probably not.

Ms. Terri's conviction that her students' learning should include science subject matter that connects to their everyday lives returned her to the past. This was not a return to past experiences teaching science. Rather, these included experiences as a science learner and the interests, personal qualities, and sense of agency they represented.

Ms. Terri's reliance on past learning experiences proves significant in how it informed her teaching practices when she opted to set aside the school's adopted science curriculum. For example, she described an alternative unit of study she planned and implemented in place of the microorganism module:

> Well, yeah, if I find a subject in science that "whoa!" intrigues me, I'll give it my best. Like when I taught the unit on oceans this year, the layers, the zones underneath the water, the living things there and how deep the water is, how cold the water is, that intrigued me, again. So, I did a fabulous unit on that.

Overall, Ms. Terri portrayed this unit as one where she "gave a lot of information" with the use of nonfiction texts, the internet, and handouts. However, she was more detailed when depicting the unit's culminating project:

> The kids made these wonderful ocean books with the different layers. It was a project and they had to gather the information, take that information and compact it. It was very cool. I mean, it's amazing how some of the kids took this project and went over and beyond what they were supposed to do. One of my girls actually made a book and her father must have got a piece of wood and they put it together and then she put her project inside! One actually made a poster board. It was amazing!

One might notice a similarity between the instructional focus of this project and the project Ms. Terri completed when she learned about and birds in elementary school. This suggested a reliance on embedded experiences learning science, as opposed to those more recent in-service experiences, to guide her practice (Bryan, 2003). As a result, she shifted away from implementing inquiry-based teaching methods:

> Like I said, I think some of the things I learned and how I was taught it was interesting. You know you focus on, from what I can guess, they made these kits with the thought of using all of the strategies that are supposed to be taught in science. It's up to the teacher whether or not, how much of the material she uses.

Discussion

When considering the literature on reform-based science teaching's absence in elementary schools, a prevalent theme is one of conflict. Studies have revealed conflict among teachers' interests in using best practices (Carlone, Haun-Frank, & Kimmel, 2010), their beliefs concerning the use of these practices (Marshall, Horton, Igo, & Switzer, 2009), and their attitudes toward teaching inquiry-based science (Gado, 2005). This research has highlighted the tension between teachers' perceptions of teaching and learning science and their orientation toward the practices of science education reform. However, Ms. Terri's narratives did not offer a steadfast discord with teaching science through inquiry. Within the context of implementing reform-based science through the use of a research-based curriculum, her construction of a science teaching identity illustrated an alternative tension.

Ms. Terri's narratives were supportive of the reform-based science curriculum and, more implicitly, its emphasis on inquiry. This was exemplified by her dialogue, which showed appreciation for the curriculum's investigative nature and incorporation of scientific practices. Yet a tension did emerge with certain content her students were expected to pursue through the use of these methods. This conflict was between Ms. Terri's personal interests in particular science subjects and a professionally situated pedagogy concerning her students' learning.

Amid stories concerning her captivation with weather, Ms. Terri connected her personal experiences and interests to the construction of her science teaching identity. However, those narratives did not solely focus on her past learning experiences. Rather, her fascination with science spanned time, encompassing more recent experiences observing storms. These interests reflect Ms. Terri's self-understanding relative to science and her agency as a science learner, constructing an identity stationed in her particular way of being in the world. This has established a lifeworld including aspects of science that continue to hold meaning and value. Moreover, it was these sustained scientific commitments that informed Ms. Terri's use of the solar energy unit and avoidance of the microorganism module. Therefore, her narratives complicate the claim that science simply is or is not a subject elementary teachers prefer to teach, a claim that relies solely upon past learning experiences to understand perceptions (Smith, 2005; Wilkins, 2010).

Ms. Terri's familiarity with this science content also enlightened her professional interests, inspired a pedagogical stance that her students' science learning be situated in their lived experiences, and further informed her discerning use of the science curriculum. Thus, it was not a singular personal or professional space that enlightened her values on what science content is worth teaching and learning. Instead, an overlap between those two spaces led her to develop and use her own science curriculum at times. In order to formulate her own science curriculum, Ms. Terri did not rely on her more recent teaching and learning experiences with the solar energy unit. She returned to her past experiences in school to determine the processes through which she and her students would pursue science. Her reliance on those embedded experiences directed her science teaching away from the use of inquiry-based practices.

As a part of her school's curricular scope and sequence, Ms. Terri participated in in-service professional development. Participating in such professional development allowed her and other teachers to partake in a module in order to better their understanding of the curriculum. As she described her experience with one of the in-service sessions, the emphasis coincided with certain findings regarding effective science teaching professional development. These findings included using the curriculum to employ activities that model lesson design and to engage teachers in those lessons to facilitate the teaching of inquiry-based science (Jones & Eick, 2007a).

However, Jones and Eick (2007b) explicated that if teachers are truly to be a part of science education reform, their individual context and interests need consideration. The construction of Ms. Terri's science teaching identity extends this discussion beyond contemplating how teachers are being asked to teach science amid their pedagogical and instructional beliefs. Her science teaching identity illustrates the need to consider teachers' personal interests and professional values regarding the central concepts of an inquiry-based curriculum. Ms. Terri's development and implementation of an ocean unit relied upon these same interests and values, which incorporated subject matter that inspired intrigue and used teaching methods she appreciated as a student. As a result, Ms. Terri's more consistent implementation of inquiry-based science was compromised. Attention to these ideals may enhance professional development by recognizing a teacher's positional identity as instrumental to classroom practice (Moore, 2008). Thus, Ms. Terri's narratives illustrate how research into teacher identity constructs can deepen understandings of practice in the context of science education reform.

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Appendix: Interview Guides

Interview 1 – Teaching History and Perceptions of Teaching

1) Tell me about your personal background.
2) Describe how you became a teacher.
3) How long have you been a teacher?
4) Where have you taught? What grade levels?
5) When and how did you know you wanted to become a teacher?
6) What factors and experiences influenced your choice to become a teacher?
7) What things about your background or life situation influenced your choice to become a teacher?
8) What role did other people have in your choice to become a teacher?
9) Looking back over your path to becoming a teacher, what would you describe as some of the more important relationships?
10) What personal values influenced your decision to become a teacher?
11) What personal characteristics do you possess that influenced your decision to become a teacher?
12) What obstacles or barriers did you overcome in becoming a teacher?
13) Describe any compromises you made in order to become a teacher.
14) Describe your teaching philosophy when you began teaching. How has it changed? Why?
15) Describe the meaning and value being a teacher has in your life. How has this changed over your career? Why has it changed?
16) What else would like to discuss that might better help me understand your personal teaching history and perceptions of teaching?

Interview 2 – Teaching History and Perceptions of Teaching at Wrightwood School

1) Describe how you become a teacher at Wrightwood School.
2) How long have you been teaching at Wrightwood School?
3) What experiences influenced your choice to become a teacher at Wrightwood School?
4) What experiences influenced your decision to remain at Wrightwood School?
5) How did your background or life situation influence your choice to become a teacher at Wrightwood School?
6) What impact did other people have on your choice to become a teacher at Wrightwood School?
7) What personal values influenced your decision to become a teacher at Wrightwood School?
8) What personal characteristics do you possess that influenced your decision to become a teacher at Wrightwood School?
9) How would you describe Wrightwood School?
10) How would you compare Wrightwood School to the other schools where you have taught?
11) How would you describe the various sub-populations that make up the employees of Wrightwood School (administrators, fellow grade-level teachers, fellow teachers, support staff)?
12) What are some of your more important relationships at Wrightwood School?
13) How would you describe the students attending Wrightwood School?
14) How do you teach to best meet the students' educational needs at Wrightwood School?
15) What obstacles have you overcome at Wrightwood School? How do these relate to meeting the educational needs of the students?
16) What compromises have you made while teaching at Wrightwood School? How do these relate to meeting the educational needs of students?
17) Describe your goals as a teacher at Wrightwood School.

18) How are your goals reflected in your teaching philosophy and way that you teach in the classroom?
19) What does it mean to you to be a Wrightwood School teacher?
20) What else you would like to discuss that might help me understand your personal teaching history at Wrightwood School and your perceptions of teaching there?

Interview 3 – Experiences with and Perception of Learning Science

1) I would like to discuss some themes I noted from the previous interview before we begin today's questions.
2) How would you describe your science education?
3) What experiences can you recall that inform that description of your science education?
4) How would you describe your perceptions of learning science?
5) How have the experiences you previously discussed, or others, informed your perceptions of learning science?
6) What in-school experiences did you have that are relevant to your perceptions of learning science?
7) What out-of-school experiences did you have that are relevant to your perceptions of learning science?
8) Among the experiences you have previously described, or others, what particular elements are relevant to your perceptions of learning science?
9) How has your background or life situation impacted your perceptions of learning science? What experiences illustrate their influence?
10) What are some of the more important relationships impacting your perceptions of learning science? What experiences exemplify those relationships?
11) What obstacles have you faced during your science education? What experiences illustrate these obstacles? How did you overcome those obstacles?
12) What expectations, either self-imposed or imposed by others, have you faced during your science education? What experiences exemplify those expectations?
13) What personal characteristics impacted your science education? What experiences illustrate those characteristics?
14) What personal values impacted your science education? What experiences illustrate those values?
15) Given what we have previously discussed, how would you describe yourself as a science learner?
16) What else you would like to discuss that might help me better understand your science education and perceptions of learning science?

Interview 4 – Experiences with and Perceptions of Teaching Science

1) I would like to discuss some themes I noted from previous interviews before we begin today's questions.
2) How should science be taught in elementary school?
3) What experiences have you had, either inside or outside of school, that are relevant to your perceptions of science teaching?
4) Last time we discussed your experiences as a science learner. How do those experiences relate to your perceptions of teaching science?
5) How was teaching science addressed in your pre-service teacher education?
6) What particular experiences did you have as a preservice teacher that are relevant to your thoughts on teaching science?
7) How has science teaching changed across your time as a teacher? How do these changes relate to what you are being asked to do as a science teacher? Which experiences exemplify the latter?

8) Describe what you would consider to be one of your typical science lessons. What is an experience you have had teaching science that would exemplify what you consider to be typical?
9) What would you describe as the expectations, either self-imposed or imposed by others, surrounding science teaching that you face today? What experiences can you describe that illustrate these expectations?
10) What makes teaching science particularly easy or difficult for you?
11) What things make it easy or difficult to teach science at Wrightwood School? What experiences have you had that illustrate these easier or more difficult aspects of teaching science?
12) Previously we discussed what you believe to be the educational needs of students attending Wrightwood School. How does teaching science address or relate to those needs?
13) Previously we discussed how and why you became a teacher more generally and specifically at Wrightwood School. How does teaching science relate to your decision to become a teacher?
14) Previously we discussed your personal teaching philosophy. How is that teaching philosophy reflected in your science teaching? What is your science teaching philosophy?
15) How does teaching science inform your professional development activities? Which professional development experiences have impacted your perceptions of teaching science?
16) Amid the experiences you have described up to this point, what factors do you believe are relevant to your thoughts and perceptions of teaching science?
17) Amid the experiences you have described up to this point, what personal values have impacted your perceptions of teaching science?
18) Amid the experiences you have described up to this point, what personal characteristics have impacted your perceptions of teaching science?
19) Amid the experiences you previously described, what things about your background or life situation have impacted your perceptions of teaching science?
20) Amid the experiences you previously described, what would you describe as the more important relationships impacting your perceptions of teaching science?
21) How would you describe yourself as a science teacher?
22) What else would you like to discuss that might help me better understand your thoughts and perceptions of teaching science?

Interview 5 – Experiences with and Perceptions of Science Curriculum

1) I would like to discuss some themes I noted from previous interviews before we begin today's questions.
2) Tell me about your school's adopted science curriculum.
3) What do you think about the science curriculum? How do you feel about it?
4) How does the science curriculum reflect or contradict how you believe science should be taught in elementary school?
5) Last time we discussed your time and experiences as both a science learner and teacher. How do you believe those experiences inform your perceptions of the science curriculum?
6) Tell me about any relevant experiences you have had with the science curriculum and why you feel these experiences to be relevant.
7) What would you describe as the teaching expectations associated with the science curriculum?
8) Describe anything that makes implementing the science curriculum particularly easy or difficult. What experiences reflect these easier or more difficult aspects?

9) What things make implementing the science curriculum easy or difficult in the context of Wrightwood School? What experiences reflect these easier or more difficult aspects?
10) Previously we discussed what you believe to be the educational needs of students attending Wrightwood School. How does the science curriculum address or relate to these needs?
11) Previously we discussed how and why you became a teacher more generally and specifically at Wrightwood School. How does the science curriculum reinforce or undermine those decisions?
12) Previously we discussed your personal teaching philosophy and science teaching philosophy. How does the science curriculum support or contradict those philosophies?
13) How does the science curriculum inform your professional development activities? What professional development experiences have impacted your perceptions of the science curriculum?
14) Amid the experiences you have described up to this point, what factors do you believe are relevant to your thoughts and perceptions of the science curriculum?
15) Amid the experiences you have described up to this point, what personal characteristics do you possess that might impact your perceptions of the science curriculum?
16) Amid the experiences you have described up to this point, what personal values do you possess that impact your perceptions of the science curriculum?
17) Amid the experiences you previously described, what things about your background and life situation impact your perceptions of the science curriculum?
18) Amid the experiences you previously described, what are the more important relationships impacting your perceptions of the science curriculum?
19) When you chose not to use certain units associated with the science curriculum, what did you plan and implement in its place? Why? What informed those planning and instructional decisions?
20) Tell me about one of the units you decided to plan and implement. What did the unit ask your students to participate in?
21) What did the lessons look like within the unit you planned and implemented? Describe what you would consider to be one of the unit's more typical science lessons.
22) What are some of the experiences you recall having with your students when implementing the unit you planned? Why do those experiences stand out?
23) What else would like to discuss that would better help me understand your thoughts and perceptions of your school's science curriculum?

Interview 6 – Exit Interview

1) Based upon our previous interviews, there are some conclusions I've drawn regarding your perceptions of learning science, teaching science, and your schools adopted science curriculum. During this final interview, I would like to discuss these with you in order to get your thoughts and reactions to the interpretations I have made.