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The Integration of Literacy and Science: An Ethnographic Case Study set in an Appalachian Elementary School

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Dedication

I dedicate this dissertation to my family. To my mother who always pushed for my best in school and talked to me about what she was reading. I am forever indebted. To my daughter, Zoe, I thank you for bearing with me all the times that I couldn't play and had to stay at my computer instead. My hope is that my work might instill a sense of grit and determination and convey to you the truth that you are worthy and you can achieve your dreams. I am honored to be your mother and I look forward to watching you grow, learn, and succeed.

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I would also like to thank my committee members for sharing their expertise and guiding me through the process. In particular, I would like to thank Dr. Anne McGill-Franzen, my committee chairperson for the time you took to read my work and provide patient feedback to steer me in the right direction. Thank you to Dr. Mitsunori Misawa for serving as my wise methodologist. Learning about Ethnography as design and method has forever changed my life! Dr. Richard Allington, thank you for helping me read about the larger scale conversations around educational policy. The influence of reading works such as Joel Spring's (2014) *Political Agendas for Education: From Race to the Top to Saving the Planet* and ensuing discussions in class about federal reform efforts like ESSA helped me understand a broader picture of science in elementary education. Dr. Stergios Botzakis, thank you for guiding me through the work of understanding content area literacy on a deeper level and for the time you took to advise me in my program. You all have impacted my development as a scholar in ways that I don't even realize yet. Thank you.

Abstract

Policy makers and textbook publishers have long discussed content integration as a necessary means for kindergarten through grade five teachers to provide generalized instruction that addresses all content standards alongside literacy and math standards. Recently, the state of Tennessee published new science standards and corresponding curriculum known as the *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages* that encourage teachers within the state to enact cross disciplinary teaching in the areas of literacy and science. This study is focused on two primary grade teachers who implemented the state standards and curriculum as well as *Inspire Science,* a commercial curriculum selected by the district and purchased by the state. Using qualitative ethnographic research procedures within an interactive sociocognitive model of classroom instruction as a framework for understanding the intersecting roles of teacher, text, and learner (Ruddell and Unrau, 2004), I sought to understand the following research questions: 1) How do two primary grade teachers interpret and enact science and literacy integration? and 2) How does the rural Appalachian setting influence the teachers' interpretation or enactment of science and literacy integration? Interviews, observations, photos, and other documents were the sources of data for the study. Findings suggested that state policy impacted the synergy of disciplinary integration. Teachers learned through implementation of new curricula in ways that enhanced their teaching practice; yet, they adjusted the curricula to meet the developmental needs of their students; and they submitted substantive ways to improve disciplinary integration. Further, place-based culture appeared embedded in the pedagogy and instruction observed in the study and reported by the teachers. An emphasis on place-based understandings may, in the future, broker rural students' understandings and interest in science and literacy.

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Chapter 1. Introduction to the Study

In a certain part of the country called Appalachia you will find dogs named Prince or King living in little towns with names like Coal City and Sally's Backbone…. The owners of these dogs grew up more used to trees than sky and inside them had this feeling of mystery about the rest of the world they couldn't see because mountains came up so close to them and blocked their view like a person standing in a doorway. They weren't sure about going beyond these mountains, going until the land becomes flat or ocean, and so they stayed where they knew for sure how the sun would come up in the morning and set again at night" (Rylant & Moser, 1991, p.1-3).

Chapter Introduction

Cynthia Rylant and Barry Moser's beautiful prose, entitled *Appalachia: The Voices of Sleeping Birds* describes a region within the U.S. known as Appalachia. This area constitutes the largest sub-culture in the United States, yet it is also one of the least understood in terms of socio political and historical impacts. Middle Appalachia specifically, the Appalachian portions of Kentucky, West Virginia, Virginia, North Carolina, and Tennessee constitute a region where the people have traditionally been isolated from the rest of the world, both geographically and culturally. Schools in this region lag behind the greater U.S. in terms of educational attainment and economic prosperity (Kannapel, Flory, Cramer, and Carr, 2015). There are increasing demands for K-12 schools in the College and Career Readiness era and they face distinctive hurdles in meeting national standards given that post-secondary education hasn't traditionally been sought after by most high school graduates from the area in past years. This phenomenon is mainly due to the fact that many jobs in the area do not require a college degree and there have traditionally been limited employment opportunities outside of the coal mining industry. With current national emphasis on College and Career Readiness and related science, technology, engineering, and mathematics (STEM) career preparation in K-12 education across the greater U.S., schools in Appalachia are currently working hard to increase initiatives to close the gaps. It is necessary for educators and researchers to identify instructional practices that promote economic development of the region within a globalized context, such as work within STEM education. To that end, this dissertation study presents a case study of teaching and learning within a K-6 classroom situated in middle Appalachia. The goal of this work is to gain insight into how two teachers interpret and enact cross disciplinary teaching practices in science and literacy and identify ways in which such teaching practices intersect with Appalachian culture.

Rationale for Study and Statement of the Problem

The rationale for investigating science and literacy teaching and learning within an Appalachian school is firmly rooted within the larger national context that emphasizes standardized test scores and is heavily contingent on using test data to allocate resources, make curricular decisions, and influence other policy at both the state and the federal levels. In fact, according to recent research reported by The U.S. Department of Education, there are achievement gaps between schools in Appalachia and the wider U.S. and much work is still needed to be done in order to close them (Wright, Cunningham, Stangle, 2016). Place-based and rural education experiences for teachers and students in Appalachia may promote STEM based proficiencies by accessing what Gonzalez, Moll, & Amanti (2005) identify as individual funds of knowledge based on students' background and culture. Given the existing challenges faced by schools in Appalachia alongside existing research about how integrating science and literacy experiences could lead to closing educational gaps and potentially benefit future STEM career opportunities in the Appalachian region, I aimed to describe instructional practices that are meaningful to teachers and students. This study is embedded in what Tennessee, specifically, emphasized in its standards and initiatives aimed at science literacy integration. Finally, I proposed to address a gap in existing research of science literacy integration by describing the influence of place-based instruction and the contribution of culturally relevant experiences.

In recent years, the Appalachian region has suffered extensively from the Opioid Epidemic, local economy crisis, and high rates of poverty (Kannapel, Flory, Cramer, and Carr, 2015). As J.D. Vance writes in his New York Times Bestselling memoir, *Hillbilly Elegy: a Memoir of a Family and Culture in Crisis*, “The statistics tell you that kids like me face a grim future—that if they’re lucky, they’ll manage to avoid welfare; and if they’re unlucky, they’ll die of a heroin overdose, as happened to dozens in my small hometown just last year” (2016, p.2). Vance writes of his experiences growing up in rural Ohio, one of several states that make up middle Appalachia.

The U.S. Census reports that 9 million people resided in middle Appalachia in 2010, which is also equivalent to 3 percent of the total U.S. population. The population in this area is primarily white (85.5 percent and 90 percent in some sub-regions), which can be compared with only 63.7 percent white nationwide. The relatively monoracial/monoethnic nature of the population contributes to cultural homogeneity in the region. Research indicates that when, “[c]ompared with the rest of the United States: The student population in middle Appalachia is, in general, poorer, less ethnically diverse, and has a higher proportion of special education students” (Kannapel, et. al., 2015, p. iv).

Poverty is another overarching theme that comes from research about Appalachia. The Census Bureau reports that the “median household income is lower in middle Appalachia than the national average. Central Appalachia in particular has a median household income some

$20,000 or 38 percent lower." (Kannapel, et. al, 2015, p.7). It is also important to note that rates of childhood poverty in Appalachia at 32% exceeds the rate nationwide. As determined through federal numbers, almost half of all children in middle Appalachia are eligible for free and reduced price lunch (Kannapel, et. al., 2015; Annie E. Casey Foundation, 2019). Larger percentages of children from this region are also raised by grandparents (Wright, Cunningham, and Stangle, 2016).

There are fewer local career opportunities in STEM based fields. Post-secondary institutions have the potential to greatly impact the educational level of the people in their respective communities. Yet, in Middle Appalachia, there is a lower percentage of the population that pursues a post-secondary degree. Furthermore, the research suggests that there is an ongoing reliance on occupations that do not require college degrees, which results in lower post-secondary degree attainment (Kannapel, et. al., 2015). Complex attitudes toward higher education, limited college-going experience among adults, and the desire to remain close to home both during and after college also contribute to this phenomenon. Students who do attend college indicate a desire to return to and improve their home communities. Together these studies suggest that unique supports may be needed for students from middle Appalachia to enroll and persist in college, including social and community supports, as well as curricula grounded in local issues to increase relevance and support students' desires to contribute to the betterment of home communities." (Kannapel, et. al., 2015,p.v).

Given the current status of schools in Appalachia, I posit that a closer look at science instruction within the early elementary grades could constitute eventual building blocks for students to move toward future STEM related jobs and post-secondary attainment, thus offering the region hope in breaking current cycles of poverty. In addition to looking at the Appalachian region specifically, it is necessary to also look at the greater U.S. trends in science achievement in order to understand the challenges and promise of STEM proficiencies in underdeveloped regions.

The 2015 Trends in International Mathematics and Science Survey (TIMSS) which is an international assessment of science and math given every five years to the nation's fourth and eighth graders. The TIMSS assessment looks at three cognitive domains in Life science: knowing, applying, and reasoning. According to the 2015 assessment results, fourth graders average score was 546 in science, which was higher than the average fourth graders score in 38 countries and lower than those average scores in 7 countries. However, there is a greater percentage of students performing at the low benchmark for science and there is no measurable difference between the average science score in TIMSS data from 2015 to 1995 or the assessment data from 2011 (US Department of Education, 2016). The 2015 National Assessment of Educational Progress, NAEP assessment results indicated that the nation's fourth graders scored thirty-eight percent proficient and twenty-four percent below proficient, which shows an improvement in average scores from 150 to 154 on a 0-300 scale score across the time period between 2009 to 2015 in all three sciences-- physical science, Earth and space science, and life sciences. Digging deeper into national assessments such as the TIMSS and NAEP to look at individual state achievement data for the state of Tennessee shows similar results, that fourth graders' averages proficient are showing growth from 148 in 2009 to 157 in 2015. However, within fourth grade subgroups, students who participate in the National School Lunch Program, an indicator of low family income, had an average score that was twenty three points lower than their classmates (National Center for Education Statistics, 2015). In 2017 49.2 percent of students in Tennessee participated in the free and reduced lunch program (Annie E. Casey

Foundation, 2019). This statistic is similar to data reported in the *Why Rural Matters Report* 2013-2014 that more than half of all rural students in Tennessee are eligible for free and reduced meal rates (Johnson, Showalter, Klein, & Lester, 2014).

When reviewing data on fourth grade assessment data in science, it is also useful to think about what the literature indicates in terms of teachers of science in the elementary grades and their qualifications for teaching science. According to *The Report of The 2012 National Survey of Science and Mathematics Education*, a survey that looked at 7, 752 science and mathematics K-12 teachers across fifty states and the District of Columbia indicated that only 39% of elementary school teachers feel very well prepared to teach science, however, "[t]eachers of science in the elementary grades are typically responsible for instruction across science disciplines. Accordingly, the National Science Teacher's Association (NSTA) has recommended that rather than studying a single science discipline in depth, elementary science teachers be prepared to teach Life science, Earth science, and Physical science" (Banilower, Smith, Weiss, Malzahn, Campbell, & Weiss, 2013, p. 15). Additionally, this survey indicated that, "thirty-six percent of elementary science teachers have had courses in all three of those areas, and another thirty eight percent have had coursework in two of the three areas. At the other end of the spectrum, six percent of elementary science teachers have not had any college science courses" (Banilower et. al, 2013, p. 15). The necessity for a teacher to possess science content knowledge and the motivation for him or her to continuously learn science content are essential in the impetus for post-secondary improvements in teacher education in the sciences.

For instance, Tennessee specifically addressed science literacy in the newly adopted 2018 science standards. Within this document, science literacy is approached as "synthesizing the nuances of information processing" (TDOE, 2017, p.14), meaning that students should be reading text with appropriate academic vocabulary as well as comprehending visual data about science through research. Students should also be exposed to writing and discussion about science content. Science literacy is designated within the new standards as,

> [e]ffective communication within a scientific context [that] requires students to apply literacy skills in reading, vocabulary, speaking and listening, and writing. Scientific information is presented in many formats with various tones and perspectives. Students must process and synthesize information effectively to generate new conclusions and ideas while avoiding the pitfalls of fallacious reasoning and bias" (p.14). In addition to reading, writing, speaking, and listening activities centered in science content, the standards also specify that activities should extend beyond the textbook and that professional development should include activities that promote, "discovery, inquiry, and the communication of scientific phenomena in multiple forms (TDOE, 2017, p. 15).

State initiatives are a response to federal mandates regarding an increased focus on science and/or STEM. The National Science Teachers Report (2016) that the Every Student Succeeds Act (ESSA) "allows state and districts to provide differential pay, or other incentives, to recruit and retain teachers in high-need academic subjects (such as math and science)" (p. 4). Current ESSA reform efforts award federal monies through recognized foundations (e.g. National Science Foundation and the American Association for the Advancement of Science) to youth programs and/or curricula that highlights STEM education and future work opportunities in STEM related professions. Tennessee is currently in the second year of implementing new science standards under ESSA reform. The decision to transition to new standards comes from the push to adopt the State's version of *The Next Generation Science Standards* (2013). In grades 3-8, assessment data from *TN Ready* exams indicated 56 percent of students were on track or mastered science, which was down from 58.6 percent in 2017 (TDOE, 2018). Students are assessed on content knowledge of life, Earth, and space sciences in third and fourth grades, and the state maintains that, "[i]n order to prepare students for content in grades 5-8 and high school, it is necessary to continue rich, engaging science and social studies in grades three and four" (TDOE, 2017, p. 6). However, science instruction oftentimes gets pushed aside for focus on ELA and math. Other sources indicate that many teachers, across the grade ranges, tend to explain science, rather than engage students in student-driven inquiry activities (Banilower et. al, 2013). According to 2018 TN Ready scores, "students across the board saw declines in science, which reinforces the need to support teachers as they transition to new science standards and a new science test in 2018-19" (TDOE, 2018, n.p.). Based on these data, it is evident that science is a priority for state leaders to boost student achievement. Over the past few years, the state has been most concerned with literacy assessment that indicated literacy scores for fourth grade reading are stagnant. According to the *Grades 3 and 4 Assessment 2017-18 Brochure*, "of the almost 6,000 Tennessee students rated below basic in third grade English language arts, less than three percent reach proficiency by fifth grade. Those students who are not reading proficiently by third grade are four times less likely than their peers to graduate from high school by age 19" (TDOE, 2017, p.1).

As a result of these findings, I advocate for a focus in teacher professional development on integration of science and literacy but within local, Appalachian contexts, "… incorporating strategies for embedding standards in place-based pedagogies and working to counter deficit views of Appalachian students and parents" (Kannapel, et. al. 2015, p.vi). Efforts to improve education within this region "...have provided much needed fiscal and material resources for education improvement, increased the diversity of stakeholder involvement, and helped equalize education expectations and opportunities for all children. Not surprisingly, those aspects of the reform that were most appreciated were those that stakeholders viewed as meeting local needs" (Kannapel, et. al.,p. vii).

With regard to these issues in Appalachia, this qualitative dissertation explores science literacy integration in two classrooms within the broader landscape of complex and continuously evolving perceptions of culturally relevant teaching and methods for cross disciplinary teaching. This work is valuable because it adds to the literature about education in Appalachian settings, particularly in terms of how STEM education is interpreted by teachers in rural settings. Such teaching is viewed in this project as a culturally relevant marker because it is a shared practice between both teacher participants within their respective classrooms. During the course of the study, the events that happened in both classrooms told a story of classroom culture as well as teacher sense of identity and decision-making. The geographical context for the surrounding school community and the experiences that both teacher participants have had in their professional teaching careers and throughout their lives growing up in Appalachia impacted their teaching practice. After presenting each teacher's individual scenario, I offered implications for how such teaching has potential for addressing many of the gaps in the literature regarding school-based initiatives aimed at improving education within the Appalachian context. Currently, there is very little research that specifically ties science literacy teaching to educational initiatives in Appalachian settings. When paired with sociocultural ideals that lead to regional initiatives in response to place-based and rural education needs, there is great promise for looking at how the implementation of science literacy teaching can benefit broader conceptions of school curricula. Such work could also be extended to explore how this kind of teaching impacts future work force and local economies.

Purpose of the Study and Research Questions

In the literature, cultural markers are referred to as reference points across physical landscapes, heritage elements, and feelings, beliefs, and meanings interpreted by the people in a specific context (Knaps & Herrmann, 2018). Guided by the idea that science literacy teaching in two classrooms within Appalachia is a cultural marker of a type of teaching and learning within rural schools, I investigated how this kind of integration is interpreted and enacted by two teachers. The research was focused on how cross disciplinary teaching and curricula intersected within a specific cultural context. I proposed that the study might suggest ways that place-based initiatives could improve this type of teaching. Thus, through the theoretical lens of a sociocognitive framework and a sociocultural view of the classroom and community, I answered the following research questions:

1. How do two primary grade teachers interpret and enact science and literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

In the remainder of this chapter I provided associated terms to the study, offered my reflexivity statement, and described the context and motivation for this study.

Definition of Terms

The following definitions are explanations of terms that I utilized throughout this dissertation and are intended to explain how I understood the concept according to the research context:

Science Literacy Integration- Science and literacy integration is a specific form of content area or disciplinary literacy, where science content becomes the context for utilizing literacies of speaking and listening, reading, and writing. Even more specific, Shanahan (2012) wrote, "disciplinary literacy is more aimed at what we teach (which would include how to read and use information like a scientist), than how we teach (such as how students read science text well enough to pass the test). The idea of disciplinary literacy is that students not only have to learn the essential content of a field, but how reading and writing are used in that field. On the other hand, content area reading focuses on imparting reading and study skills that may help students to better understand and remember whatever they read" (p.7)

Synergy- According to the *National Science Teachers' Association Reports Online*, "[i]ntegrating science and literacy involves learning through firsthand investigation or hands-on science activities, along with secondhand text investigations. This approach requires learning through multiple modalities: doing, talking, reading, and writing" (Shapiro, 2006, n.p.). According to the literature, synergy is when the disciplines of science overlap with literacies in a fashion that becomes mutually beneficial or both disciplines engaging in ways that are more effective than treated separately (Tyler, Britton, Iveland, Nguyen, Hipps, Schneider, 2017).

Middle Appalachia- According to the Appalachian Regional Commission (1965) this area encompasses Kentucky, West Virginia, Virginia, Tennessee and North Carolina. This region sits geographically within the middle Appalachian Mountain range.

Place-Based Education- Based from the ideals communicated through *Place-Based Education: Connecting Classrooms & Communities*, this concept involves creating partnerships within the school and local communities in order to "engage students in real-world projects in the local environment and the community" (Sobel, 2004, p. 53). In the current study this means that local ecology in Appalachia affords natural opportunities for teachers and students to engage with science.

Rural Education- Based from information from the U.S. Census Bureau (Ratcliffe, Burd, Holder, & Fields, 2016) rural communities are distinguished from urban regions through consideration of proximity to settlement patterns and availability of resources and services. According to this information, rural areas are less dense, with a sparse population of people, can be geographically isolated, are not built up, and are at a distance.

Culture- In the context of this research, the concept of culture is any set of shared beliefs, social forms, features of existence, discourse, activity or ritual within a classroom or a community context.

Reflexivity Statement

"Those who did go off, who find some way to become doctors or teachers, nearly always come back to the part of Appalachia where they grew up. They're never good at explaining why. Some will say they had brothers and sisters still here and they missed them. But most will shake their heads and have a look on their faces like the look you see on dogs who wander home after being lost for a couple weeks and who search out that corner of the yard they knew they had to find again before they could get a good sleep" (Rylant & Moser, 1991, p.7-8).

My interest in Appalachia is not born from a fascination, but of a reality of existence. I have resided in rural, middle Appalachia for my entire life, however as a young adult I moved from my hometown in a small rural town to a more urban setting in a nearby city. I am like the old dog from Rylant and Moser's writing above. I moved away from my hometown for more than a decade, but for one reason or another, I returned home in my mid-thirties to raise my daughter and plan to remain there for life. I am a white female who was born and raised in the middle Appalachian state of Western North Carolina. My Appalachian community is one that

Katherine Kelleher Sohn refers to in her pivotal ethnographic account of *Whistlin' and Crowin' Women of Appalachia: Literacy Practices since College* as a group of minorities that could be referred to as "color with no name" (2006, p.1) or as Purcell-Gates described as, "the white underclass, minority within the nation's white majority" (1997, p.2). I offered my statement of reflexivity in relation to this research and strived to make transparent who I am as a researcher investigating a case of teaching in rural, middle Appalachia. Such disclosure is aimed at openly confronting potential bias in my interpretation of information as I seek to examine the world around me.

Researchers "position themselves" in qualitative research. This means that research should convey (i.e., in a method section, in an introduction, or in other places in a study) their background (e.g., work experiences, cultural experiences, history), how it informs their interpretation of the information in a study, and what is to be gained from the study. As Wolcott (2010) said:

> Our readers have a right to know about us. And they do not want to know whether we played in the high school band. They want to know what prompts our interest in the topics we investigate, to whom we are reporting, and what we personally stand to gain from our study (p.36).

Likewise, Gobo and Molle write, "being simultaneously, or intermittently, 'inside' and 'outside' of the cultural code is therefore a normal component of the researcher's role" (p.9). Preissle and Grant (2004) write that "[t]he purpose of a subjectivity statement is (1) to help researchers identify how their personal features, experiences, beliefs, feelings, cultural standpoints, and professional predispositions may affect their research and (2) to convey this material to other scholars for their consideration of the study's credibility, authenticity, and overall quality or validity" (p.844).

From my cultural standpoint, I feel as though the description above (Rylant & Moser, 1991) of persons from Appalachia depicts my personal journey throughout my early adulthood experiences. I grew up in a rural Appalachian region and spent my childhood playing in the mountains, engaging in the rich cultural traditions known to the area such as quilting, farming, and singing each Sunday morning in a small Pentecostal church with friends and neighbors. Coming up through the eighties and nineties and having two older sisters in their teenaged years, I was not isolated from pop-culture to include loving music by artists such as Prince and Madonna. However, I grew up in a setting without much mass media and technology, unlike the current generation of children growing up in Appalachia today. I remembered struggling to catch a signal for TV channels with a manual antennae in the front yard, a situation not ideal for sitting in front of the TV all day. Maybe it was for this reason or because of genuine interest that I played outside so much in my childhood. As I grew older, I moved outside my local community to a more urban setting (albeit still considered Appalachia) to teach in several elementary schools over the years. It wasn't until later in life that I returned to my childhood community to build a house and raise my daughter. Comparable to the excerpt by Rylant & Moser, I knew that eventually in life I wanted to return home, just as "… dogs who wander home after being lost for a couple weeks and who search out that corner of the yard they knew they had to find again before they could get a good sleep" (Rylant & Moser, 1991, p.7-8). From my perspective, no other place would be good enough to raise my daughter, because home in the Appalachian Mountains offers what Richard Louv describes in his bestselling novel, *Last Child in the Woods: Saving our Children from Nature-Deficit Disorder* as nature being "…natural wildness:

biodiversity, abundance—related loose parts in a backyard or a rugged mountain ridge. Most of all, nature is reflected in our capacity for wonder" (2008, p.8-9). And, as I engaged in research of science and literacy, I felt validated through watching my young daughter, who is now seven years old, express curiosity over a woolly caterpillar or maintain focus over a Poplar tulip in order to capture its beauty in her painting project. I am proud of the fact that she digs for worms, hunts spotted salamanders in the nearby creek, and constructs mud pies for her imaginary bakery operation. Such childhood activity indicates a motivated intellect and imagination, and is what I believe sustains her capacity to be engaged in what educational research identifies as science, engineering, technology, and mathematics (STEM) related learning. I hope that all children have access to the richness of place-based culture in science learning!

In addition to my experience parenting a young child in rural contexts within Appalachia, my professional experiences also informed my work within this research context. Having served as a teaching practitioner in the K-6 classroom situated me within an emic, or inside perspective of the role. Likewise, I understood the trials and celebrations of classroom instruction, because I served as a K-6 teacher for more than a decade. During my years as an elementary educator, I developed an understanding of constructs of constructivism and that there are numerous ways to perceive truth and learn information. After having spent many years in the classroom working with at-risk and gifted student populations, I learned that children learn in a variety of capacities and are generally motivated by hands-on experiences and inquiry alongside authentic experiences with interesting text. I believe children benefit more from a community of practice that privileges questioning and engages children in rich discourse around subject matter collectively versus memorization of facts in isolation.

My perceptions of science literacy instruction are also influenced by my experiences working as a K-6 instructional coach. After my years of teaching in the classroom, I served in this capacity and provided job-embedded professional development and co-teaching experiences for teachers. At the district level, I was assigned to the domain of science by my administration as we worked as a district leadership team to roll out the Common Core State Standards (CCSS) in fall 2010. It was my charge to attend all the professional development offered by the North Carolina State Department of Public Instruction about science in order to bring it back to colleagues and district leadership so that we could all work collectively to disperse the information and promulgate implementation within our individual school sites. I am a person with a strong background in literacy—having completed a Master's degree in English Education and having eight years of experience serving as a chairperson for school-wide literacy teams in some capacity; the focus on science was a new endeavor. These experiences initiated my interest and motivation to learn more about science and literacy integration. Forward on, I worked with teachers and district leadership to explore ways to integrate science and literacy within the existing curriculum.

During the initial years of my work with science and literacy integration, I concentrated on what Roberts (2007) identifies as Vision I category of science literacy that is primarily concerned with the question: What must people know and be able to do to be science literate? During this phase of my scholarship, I worked with teachers on building content knowledge through professional development and use of guiding documents such as the *Atlas of Science Literacy* (AAAS, 2001) and *Science Matters: Achieving Scientific Literacy* (1991), and Pratt (2012) *A Framework for K-12 Science Education*. These keystone documents provided information about cross-cutting concepts of science and how those concepts are arranged in grade level progressions in Kindergarten through twelfth grade curricula. In retrospect, I now realize that in my experience, I have progressed from a stage of identifying the science that teachers had to know in order to integrate science literacy, or Vision I (Feinstein, 2011) to a stage of trying to understand how teachers do it, or a Vision II that is primarily concerned with how such integration is implemented in various classroom settings (Feinstein, 2011).

Subsequently, it is possible that my career experiences may influence me to empathize with or criticize the teachers I speak with about the topic of integrating literacy and science because I brought my own ideas of what is best practice in terms of pedagogy and instructional strategies with me as I interpreted any resulting data and/or discourse patterns associated with instructional practice. While I felt it necessary to support my thinking about cross disciplinary teaching practices with research, I also believed it necessary for me to continually revisit the nature of adult learning as an individual process. Constructivism postulates there are many versions of perspective and truth, thus it is my goal to understand how individual teachers interpret science and literacy integration through the filters of background experiences, cultural impacts, and existing structures within the teaching profession.

I was positioned within my dissertation study in an interchangeable stance as both insider and outsider participant to the research. On one hand, I shared the space of the classroom as someone native to rural, middle Appalachia, just like the majority of students and the classroom teachers. I am also an elementary school teacher by profession, therefore I was situated from an insider's perspective in that light. However, it is important for me to make evident to the reader that I was also situated from an etic, or outside standpoint, as my role of university faculty, researcher, and Ph.D. candidate, and because of this I had to be vigilant of any instances where I could potentially superimpose my thinking on the reporting of my participants' experiences. In an effort to retain transparency of intent, I strived throughout the study to remain intuitive toward any possible tensions between my presence and the natural happenings between the classroom teacher and her students. I tried to remain cognizant of the energy that my presence brings to the research environment, I ensured validity in methods for collecting and analyzing data as a "researcher as instrument" in ethnographic research. Merriam & Tisdell wrote, "[t]he key concern is understanding the phenomenon of interest from the participants' perspectives, not the researchers" (p.15). Because in qualitative research, the instrument is the researcher, the work is deeply engrained in understanding how the participant is experiencing the phenomenon of study. Thus, there is value in that I openly confronted my inside perspective, or how I was situated for gaining access to inside knowledge of the event of teaching. I strived to make this confrontation apparent in the written account by providing data excerpts from my expanded field notes and using data excerpts from the participants' verbatim discourse. My ultimate goal was to maintain reflexivity, or self-awareness in relation to the participants I studied.

Chapter Summary

In this chapter I outlined my purpose for studying science and literacy integration in Appalachia. I provided a rationale for the study in relation to existing gaps in education and translated this into two research questions for how I would organize the study. I highlighted important terms to the study and offered my statement of reflexivity to make transparent my background in relation to the study and my personal motivation to study the topic. I also strived to be clear about any possible biases I may have in relation to the study and proposed research actions to help me stay true to my purpose throughout the study activities.

Chapter 2. Literature Review

As described in Chapter 1, my experience in Appalachia, as well as my initial literature review of research on both Appalachian culture and schools led me to the following research questions about science and literacy integration:

1. How do two primary grade teachers interpret and enact science and literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Chapter Introduction

In this chapter I reviewed academic literature in the following areas: 1) the framework of social constructivism situated within a sociocognitive model as a lens for analyzing science and literacy integration; 2) a review of the findings in literature about science and literacy integration; 3) the specifics of the science and literacy integrative curricula currently being used in the teacher participants' classrooms spurred by state and local policy directives.

Section I: Theoretical Frameworks

Research indicates that it is necessary to explicate world assumptions and interpretive frameworks that undergird the inquiry process of developing a study, identifying the problem, and choosing appropriate methodology (Lincoln & Guba, 1985; Lincoln, Lynham, & Guba, 2018). Such a comprehensible framework should be clarified early on in any report in order to situate the researcher's interpretation of the phenomenon of study. Therefore, in this section I discussed the theoretical frameworks underpinning this study. As the researcher, I am focused on the intersection of science literacy teaching in Appalachia, so it is important to note that the work is situated in the context of a classroom community within Appalachia; therefore I viewed my work through a sociocultural theoretical lens to describe how this community of learners, led by the teacher, made sense of both science and literacy when presented as integrated practice. Additionally, I also presented the interactive sociocognitive model of classroom instruction (Ruddell and Unrau, 2004) to lend theoretical support to the intersecting roles of teacher, text, and learner in science literacy integration. Socioculturalism and sociocognitivism in this research were both viewed as forms of inquiry into the use of language as a meaning making phenomenon and as a cultural marker that is situated within a unique community of practice. The key facets of the theoretical underpinnings were presented in Figure 1 and I also offered a detailed description of each theory and how they intersected to help answer the research questions of this study.

Theoretical Perspective		
Social constructivism	**Sociocultural perspective of teaching, learning, and language use**	**Socio cognitive model of classroom instruction**
Communities of Practice, collaboration and group/individual meaning making in science and literacy, Inquiry-based instruction	**Social nature of learning, zone of proximal development, practices that are deemed appropriate by the field of study and standards**	**Three main components- teacher, text, classroom environment; This model helps us to think about how the teacher is situated within the learning event; intertextuality and dialogism**

Figure 1 : Overview of the Theoretical Lens Applied to the Study

Social constructivism. One of the assumptions underlying the National Science Education Standards is that "student understanding is actively constructed through individual and social processes" (National Research Council, 2012, p.28). Traditionally, science education assumed more positivistic stances within behavioral theory; however, in more current years constructivist ideas about learning are accepted in both science (Appleton, 1997; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Tobin, 1993) and literacy (Bruner, 1986; Greene & Ackerman, 1995) disciplines. Some constructivist approaches have emphasized the personal construction of knowledge in which the individual's unique experiences within the learning environment are the most dominant focal points, whereas others have underlined the importance of social processes in facilitating cognition (Nystrand, 1990; O'Loughlin, 1992; Piaget, 1950). This study approached the work of integrating science and literacy from both standpoints. I strived to uncover more about the individual experiences of the teachers as they planned and facilitated science and literacy integration, as well as described the synergies of the individual disciplines aligned within the flow of the lesson. Both those aspects indicated information about how knowledge or cognition was evolving, as well as how culture constituted an integral component to the learning event.

Sociocultural practices in science and literacy. Sociocultural theory provided a worthy framework to this research. Science and literacy integration was understood through study of disciplinary practices that were demonstrated by teachers and students collectively engaged in inquiry, experiential learning, and discourse. According to this lens, learning was seen as a direct result of social engagement. Communities of practice (Lave & Wenger, 1991; Wenger, 1998) participated in the discourse involved in science inquiry, the talk about text, and the purposes for reading and writing. Student and teacher discourse within these areas was meaningful as an indicator for knowledge evolving, and the culture in which learning takes place.

Additionally, language represented social engagement about learning that has happened or is in the process of occurring (Bakhtin, 1987). Within the study, the language of inquiry shared between students and teacher was key in demonstrating that disciplinary learning in the area of science can be reconceptualized as a social event that uses practices of discourse and the interplay of roles to indicate “grasps of practice” for students in the construction of knowledge about science (Ford & Forman, 2006). These ideas reflected basic notions about socioculturalism in terms of language use and the interaction of participants within a social group that is studying a discipline.

Disciplinary learning in classrooms was conceptualized as sociocultural practice within a community of practice because participants shared a language, communicative habits, and mutual engagement in scientific practices (Ford & Forman, 2006). Rather than looking at the integration of science and literacy as mental functions of memory, reasoning, and language as output resulting from input of the former (Cole, 1996; Ford & Forman, 2006), I believed that discourse was a key indicator for examining evolving understandings.

Sociocognitive model and the teacher’s interpretations. Ruddell and Unrau (2004) wrote about the concept of using a sociocognitive interactive model to understand reading: “It is the teacher who frequently assumes major responsibility for facilitating meaning negotiation within the social environment of the classroom” (p. 1015). Therefore research that provides thorough description of the teacher situated in specific instructional contexts becomes useful in impacting future educational initiatives as we learn more about what place-based factors impact a teacher's practice. This sociocognitive model of literacy development (figure 2) comes to life through the complex interactions of the teacher, the classroom context, the text, and the reader.

In the current study of the integration of literacy and science a sociocognitive interactive model, displayed above in Figure 2 was applied. The role of the teacher was especially important within science and literacy integrative contexts. Research suggested that it is important for teacher professional development to occur to help teachers realize the, "…change in terms of the kind of classroom talk that teachers facilitate" (NRC, 2014, p.12). Teachers assume a pivotal role in the promotion and facilitation of discourse patterns and in teaching students to engage in the types of discourse that is employed by actual scientists in reading, writing, and talking.

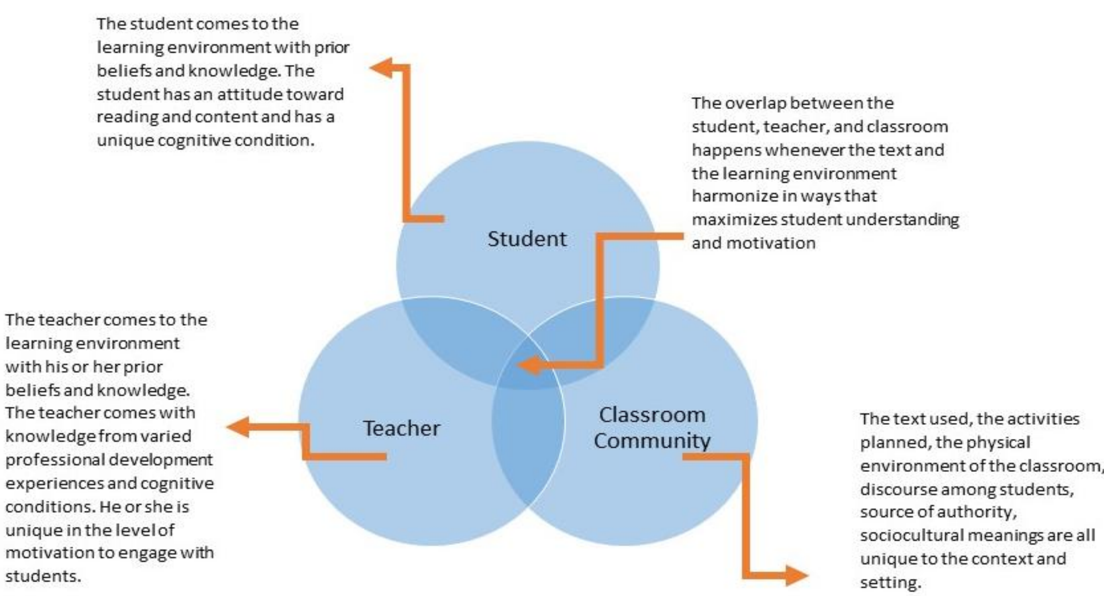


Figure 2 : Adaptation of a Sociocognitive Interactive Model (Ruddell & Unrau, 2004)

In order to look closely at the role of the teacher in this process, it was helpful to return to Ruddell and Unrau's (2004) description of the complex nature of how the teacher approaches any curricular or pedagogical endeavor. According to Ruddell and Unrau, "[t]he teacher's knowledge use and control includes the instructional decision-making process that forms general instructional purposes based on prior beliefs, prior knowledge, and concurrent classroom conditions. This general purpose directs the flow and conduct of instruction through specific purpose setting, planning and organizing, and strategy construction" (Ruddell & Unrau, 2004, p.1017). According to this view of the teacher within a sociocognitive interactive model, a meaning negotiation process occurred as a result of the teacher's executive teaching strategies and his or her instructional orientation toward student learning and instructional content. Furthermore, " [t]he outcomes of instructional decision making for the teacher range from forming new semantic/lexical knowledge and interpretation of text to insights into reader affect and cognition and reflective insights into instruction" (Ruddell & Unrau, 2004, p.1017).

Using adjectives such as dynamic, interchangeable, and interwoven to describe three main forces in affecting learning, Ruddell and Unrau helped to develop and explain the various moving parts of the model in relation to the individual learner, the context for which learning takes place, and the knowledge and decision making of the teacher. Reading (and I posit knowledge construction of science) can be viewed as social cognitive processes in this light. Alexander & Fox (2004) described this kind of learning as "…no longer seen as the development of an individually held body of knowledge, but rather the creation of a mutual understanding arising in the social interaction of particular individuals in a particular context at a particular time" (p. 46).

Summary of Theoretical Frameworks

The goal of this study was to examine the intricate uptake and enactment of science and literacy teaching in two elementary classrooms. As such, Ruddell and Unrau's (2004) sociocognitive model of reading as a meaning-construction event, dependent on the complex interactions between the reader, the text, the classroom context, and the teacher, informed data analysis of interview transcriptions and classroom observations. This model offered entre into the affective conditions within a science and literacy context that motivate a student to engage in the work. In turn, the model also validated an examination of the values and beliefs behind the teacher's decision making in how to present texts and science experiences within the science literacy integration event. A sociocultural stance, as in the model, facilitated ascription of meaning to the interactions that took place within the community of practice.

Section II: Review of the Literature on Science Literacy Integration

In the past three decades, the research and resulting literature have placed increasing demand on curricula that emphasizes hands-on science and student-centered inquiry versus text based work in science and literacy integrative activities (Cervetti, Pearson, Greenleaf, & Moje, 2013). However, such emphasis was not always the case, as traditionally, literacy and science have been treated as separate entities within the mainstream educational standards and programs, with minimal time devoted to science instruction that includes hands-on investigation at the elementary grades (Cervetti, et. al, 2013). In this section, I presented a short history of science and literacy integration across time and discuss what the literature continues to emphasize in terms of synergy of the disciplines in integration. Finally, I discussed how the study of science and literacy integration in Appalachian contexts could contribute to the growing body of literature about the cultural aspects of science teaching that constitutes as place-based educational practices.

Historically in the literature, the notion of scientific literacy was traced as a debate between two main forms of teaching science, one that privileged text based instruction and the other that favored inquiry or hands-on science investigation. These notions were based from what Norris & Phillips (2003) described as the dual roles of literacy within a framework that integrated literacy with science, 1) the fundamental science of scientific literacy, and; 2) the derived sense of science literacy. Within these two conceptualizations of scientific literacy, the derived sense was on “understanding some of the key concepts and principles of science; having a capacity for scientific ways of thinking” (Rutherford and Ahlgren, 1990, p.x). While the derived view of scientific literacy was focused on understanding the science, the fundamental sense was more concerned with “…the ability to make meaning of oral, written, and visual language representations….” (Cervettt, et. al, 2013, p.101). The fundamentalist view was that science must involve literacy in all forms and any attempt within the literature to isolate the literacy work from science is counterproductive. For the past twenty years, the focus of the field has been on scientific literacy that emphasizes both aspects of literacy and science in ways that work in tandem to increase the benefits of both disciplines equally, thus is known to demonstrate synergy of the disciplines. And while the current literature reflected the view that reading, writing, and hands on science inquiry are integral components to integrative curricula, historically there has been a divide between the disciplines.

Throughout history, educational theorists have promoted cross-disciplinary integration as instructional practice versus segmenting the disciplines to teach in isolation (Drake & Burns, 2004). John Dewey, one of history’s leaders in the movement for school reform during the

Progressive Era summed up the idea behind content integration as, “We do not have a series of stratified earths, one of which is mathematical, another physical, another historical, and so on. All studies grow out of relations in the one great common world” (1915, p.80). Despite early perceptions regarding interdisciplinary curricula as a characteristic of progressive education in the literature, entities of power within school science programs emphasized textbook-driven instruction and fact-based curriculum that focused on products of science (knowledge) rather than the process of working through science (Cervetti, et. al, 2013). With the appearance of Sputnik in 1957, there was born a growing movement to reform science education to include more work with inquiry in science (Bybee, 1997) however, still fell short of impacting a larger movement to base teaching primarily through textbook-driven instruction. Textbook-driven inquiry in science continued into the early nineties, with a clear divide in schools of thought around how to teach science as inquiry only or text-based only. Current research however, came in the aftermath of an overhaul in standards and a rise in focus and attention on the overlapping nature of standards in both English Language Arts and science with suggested practices in the disciplines (refer to Appendix A). Conceptions of science in the guiding documents suggested that educators must include work on teaching students the dispositions behind curiosity in science and practices of science that extend beyond basic memorization of facts (Cervetti, et. al., 2013). The goals of science education have further been clarified, such as through the pedagogy and practices identified in The Next Generation Science Standards (NGSS) criterion for what the science in science literacy constitutes (2013). The major components of these standards include the presence of student-driven inquiry, knowledge of content, and experiential learning as non-negotiables of science education. Furthermore, formal educational experiences are well-grounded in science practices detailed in standards:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

The science practices that are specified within the standards undergird the spectrum of content within K-12 domains and are applicable within all science teaching contexts. Linn (2000) described the roll out of NGSS, initiated in 2011, in that they, "clarified the definition of inquiry by specifying learning practices such as developing models and designing solutions. They also underscored the importance of knowledge integration by identifying cross-cutting themes and core ideas" (p. 548).

Likewise, the English Language Arts Common Core Standards, ELA CCSS (National Governors Association, 2010) roll out as national standards marked a major concern focused on supporting the shift from students' learning to read, toward students' *reading to learn*, which marked a higher push in the standards for students to build background knowledge from varied sources and informational texts. Such a shift negotiated a movement toward building college and career ready students through a K-12 program that necessitated complex text and reading to boost knowledge (Shanahan, 2013; Hiebert, 2009; Walsh, 2003). In fact, the standards addressed disciplinary literacy specifically: "[p]art of the motivation behind the interdisciplinary approach to literacy promulgated by the Standards is extensive research establishing the need for college and career ready students to be proficient in reading complex informational text independently in a variety of content areas" (CCSS, 2010, p.4).

The overlapping of standards and practices (refer to Appendices, Part A for figure that outlines the correlations between the standards) are approached in this work as a descriptor for how both disciplines interact in ways that indicate synergy of teaching within community of practice that builds culture within the classroom. That is, the work of teaching from both disciplines are mutually beneficial as impacting learning rather than being treated as separate disciplines in isolation. However, this is not the sole purpose that science and literacy teaching practices offered in terms of providing accessibility for learning through cross disciplinary integration. The movement in national standards documents to identify specific practices for content specified a movement away from coverage of standards to an era of focusing on the kinds of practices teachers should employ for their students to dig deeper into conceptualizing content material. In this movement away from traditional teaching, the teacher becomes less of a knowledge imparter to a learning facilitator. In fact, according to current literature (NRC, 2014) "…these practices are a central focus of the NGSS, and they emphasize developing and using science, rather than learning *about* science" (p.8). According to Reiser,, "the use of these practices to build understanding is also in service of building a depth of knowledge about core ideas in science. Ideally, coherence should exist within and across the scientific disciplines to help students build a storyline of explanation that builds upon their prior knowledge" (quoted in NRC, 2014, p. xxx).

As the practices between both ELA and NGSS continue to be analyzed in the literature according to how they overlap (Appendix A.), there continues to be a gap in the literature about how teachers vary in their interpretations of synergy between this disciplines, and there is no existing formula or suggested method of blending the components of both disciplines together in tandem. This is an issue, because teachers of science and ELA disciplines respectively can interpret the practices differently. This is shown particularly in the practice of argumentation, which has become something of a policy debate about whether it is a topic in science rather than an event that makes sense of science phenomenon (NRC, 2014).

Such discrepancies in interpretation offer opportunity for current research to help maximize opportunities to explore what Pearson refers to as ‘synergy’ between the disciplines (NRC, 2014). Specifically, future research encourages the educational community to think instead about the mutual benefits of integrating literacy with science according to their synergies within a sociocultural framework. Pearson referred to this as a, “…focus on the bridges rather than the barriers between the two” (NRC, 2014, p. 9). The synergies between the disciplines existed in the opportunities for, “placing value on evidence, constructing viable explanations, communicating ideas, engaging in argument based on reasoning, and being able to critique the reasoning of others” (NRC, 2014, p.10). However, the research indicated that the possibilities of such synergy between the disciplines should not be limited to these criteria, but could also be explored in terms of providing authentic reasons to read and write contingently with the experiential component contained within hands-on inquiry activities. When interwoven, reading, writing, use of language, and science hands-on inquiry promoted the acquisition of vocabulary and comprehension skills in powerful ways. Synergy became a description for how the individual components of both ELA and science are positioned within a unit of teaching in ways that increase the maximum potential of learning in both disciplines simultaneously (Cervetti, et. al., 2013). Further in this section, I outlined the individual components of science and literacy integrative curricula that has been shown to positively impact student achievement in both disciplines according to the literature.

Synergy 1. Student-driven inquiry. The key elements and defining features of notable science and literacy instructional models included student-driven inquiry (NRC, 2014). In fact, many researchers insisted that in order for the type of classroom culture that is embedded in the study of science and literacy to exist, a particular stance about learning and knowledge is required: "…that is, a culture that supports engaging in a range of science and engineering practices and values productive struggle toward understanding" (NRC, 2014, p.11). Learning within this framework includes being centered in answering questions in an inquiry-based stance to science learning.

Inquiry also included the use of technology (Yerrick & Roth, 2005; Pedretti & Nazir, 2011); the development of metacognitive strategies in reading science text (Koch, 2001; Guthrie, et., al., 1999); and motivational classroom practices (Pedretti & Nazir, 2011; Guthrie, et. al., 1999; Palinscar, 2000; Palinscar & Magnusson, 1997, 2001; Lomangino, 2000; Miller, 1999; Collins, 1999). Anne Marie Palinscar and colleagues' work at the University of Michigan, the Guided Inquiry GsML model, was fundamental in understanding how the teacher oriented students to science discourse communities, concept building, and inquiry based activities. Within an inquiry-based lesson, students worked collaboratively to brainstorm questions, designed procedures for testing their predictions, carried out investigations, and asked thoughtful questions about other students' conclusions. This mirrored the social context in which "real science" takes place.

Inquiry-based teaching focused on major concepts, helped students build a strong base of factual information to support the concepts, and gave them opportunities to apply their knowledge effectively. Inquiry-based teaching uncovered students' prior knowledge and, through concrete explorations, students learned to correct misconceptions. In an inquiry-based model, students gave priority to evidence when they prove or disprove their preconceptions (Dyasi, 1999). Their preconceptions were challenged by their observations or the explanations of other students. When teachers used inquiry, students assumed much of the responsibility for their own learning. Inquiry provided students a variety of opportunities to practice what they have learned, connected it to what they already know, and therefore it moved them toward application, a sophisticated level of thinking that requires them to solve problems in new situations.

Research also demonstrated that hands-on inquiry experiences increased student motivation in learning (Brunsell & Fleming, 2014; Marshall, 2013; Mervis, 2016; Katz & Chard, 2000). In a meta-analysis of the teaching of science, Schroeder, et al. (2007) noted that that effect sizes for certain teaching practices impacted students' academic achievement and level of engagement. The largest effect size in this study showed that technology can be used to provide learning activities that promoted this type of engagement. Specifically too, Schroeder et. al. wrote that "collaborative learning strategies such as flexible heterogeneous groupings and group inquiry projects also displayed a strong effect" (p.1452). This research highlighted teaching strategies that fostered questioning in the service of hands-on learning and engagement with text versus traditional teaching methods for skill and drill of science content. Guthrie, et. al., (2000) conducted a quasi-experiment to look at Concept-Oriented Reading Instruction (CORI) that integrated language arts instruction with science inquiry and realized effect sizes of 1.94 for curiosity and 1.71 for strategy use in children within the CORI learning contexts. Content, in this context of concept-oriented instruction, is found to become an intrinsic reading motivation (Guthrie, et.al. 2000). Likewise, other related research identified technology, text diversity, concept oriented instruction, and a high level of student-centered inquiry as core components for boosting student motivation and achievement (Allchin, et. al., 2013; Blanchard et. al., 2010).

Synergy 2. Language. The art of promoting classroom discourse practices within instructional contexts remains vitally important in the literature about teaching in cross disciplinary fashion. Pearson expanded upon the role of language use within the literacy and science integrative unit as consisting of more than just using words to label concepts and practices. As such, “learning the language of science entails learning an array of words that can be organized into conceptual networks. Science involves using particular language to describe, predict, synthesize, and argue, based on certain norms and conventions that differ from those used in everyday life….” (NRC, 2014, p.11). Research thus suggested that learning about science required students to learn how to use the language of science, both oral and written. Chen, Hand, and McDowell (2013), at the University of Minnesota, conducted a study of writing to learn activities with 835 fourth graders and 416 eleventh graders. Through this work, students were shown to be positively impacted through writing as communication of scientific concepts; and the authors highlighted argumentation in writing as a valuable protocol for science literacy integration.

Additional research also suggested the role of oral and written language within integrative contexts was a crucial aspect in which for teachers to foster students’ growth. Moje, from the University of Michigan, serves as a steering committee member on *Exploring the Overlap between “Literacy in Science” and the Practice of Obtaining, Evaluating, and Communicating Information* project taken on by the Board on Science Education through the NRC. Moje, alongside Pearson, stated that in order to teach the language of science, teachers should be cognizant of the words, phrases, and symbols of a science subject area and be intentional about guiding students to use the language of the discipline in ways that are a form of public interchange within the classroom community (NRC, 2014). As an additional voice from the committee, Michaels, Clark University, promoted the idea that central to the overlap in standards between the disciplines of ELA, math, and science "…is placing value on evidence, constructing viable explanations, communicating ideas, engaging in argument based reasoning, and being able to critique the reasoning of others" (p.10).

Promoting these ideas further, researchers (NRC, 2014), suggested, that in order for students and teachers to engage in discourse appropriate to science and literacy integration, it is important to use, "…academic and disciplinary language to communicate ideas and to understand the reasoning of others through listening, speaking, reading, and writing" (p. 12). Such public thinking within a community of discourse therefore involved talk around shared activities and joint attention to a concept in order to grow knowledge collectively during the process of study. Furthermore, discourse in content areas was emphasized heavily in CCSS in ELA as well as NGSS (refer to Appendix A).

Science models identified through research that emphasized talk, for instance, Anderson, West, Beck, Macdonnell, and Frisbie (1997) developed the Wondering, Exploring, Explaining (WEE) model that involves questioning as a crucial practice in the process. Students engaged in reading activities and hands on lab activities to ask and answer questions, using both the experience and text versus the text as the sole authority on the topic. Such work calls for students to consider author's style and purpose in communicating the information regarding the science concept. Alongside the discussion from the hands-on lab, it was crucial for the discourse to also utilize the ideas and information from texts, graphics, media, and other students to craft their explanations, descriptions, and arguments about concepts in science.

Pappas, Varelas, Barry, and Rife (2002) looked at the discourse in science and in teacher reading aloud of science text and found that discourse is a key component for how students use intertextual links between reading, writing, and hands on inquiry to express understandings about science and literacy. Such discourse can strengthen argumentation skills, refine vocabulary, and clarify misconceptions of science phenomenon.

It is also important to note that there is still research to be done on how language and culturally relevant instruction looks specifically within larger language contexts, such as Appalachian communities. For instance, studies conducted by Yerrick & Roth (2005) looked at how lower academic performing students performed in the science classroom as illustrated through their science argumentation and they found that culturally responsive teaching in science helped diverse learners find success and equal access to the curriculum. Such research could potentially suggest how larger cultural contexts impact science and literacy instruction and could work to "fine tune" such instructional programs to meet the needs of students and teachers in local contexts.

Synergy 3. Text use. After having considered the role of language in science and literacy integrative contexts, research also considered text use as an individual component in science and literacy integrative teaching. Work has been done to promote comprehension strategies applied to core content textbooks. For instance, Koch (2001) looked at the effect of applying metacognitive strategies in physics and found such work improved students comprehension skills. Baker (1991) also looked at comprehension strategies applied to science texts, specifically metacognition and found that such strategies were enhanced by text use after having undergone a science experience. Much of the research (Morgan & Ansberry, 2007) promoted the idea that literature gives students a context for the concepts they are exploring in the science classroom.

Additionally, the colorful pictures and graphics in picture books are superior to many texts for explaining abstract ideas (Kralina 1993). Many research studies have focused throughout the years on analyzing how text is placed within science and literacy integrative units. For instance, Guthrie, Anderson, Alao, and Rinehart (1999) reported on a year long study that conducted a CORI intervention in five third and fifth grade classrooms. CORI was oriented around a science goal and offered direct instruction of reading strategies alongside hands on experience in order for students to make connections between the experience and the reading. The research findings from this model found that CORI program increased students' strategy use, conceptual learning, and text comprehension.

Additionally, Palinscar and Magnusson (2001) reported on a quasi-experimental study to compare fourth graders studying light. This study looked at how secondhand or text-based experiences in science could inform first hand experiences in the science lab. Text use within science literacy models can enhance students' understandings of author's purpose, metacognitive reading strategies, as well as provide opportunities to engage with complex vocabulary.

It is additionally important to note that the science notebook was an important component to this model and was shown to help with comprehension of complex expository text. When used as a mechanism to aid in the comprehension of dense, expository language within science textbooks, the science notebook constituted formal language use in a permanent record of learning, and often times the only resulting artifact from an integrated unit.

Some of the current research (NRC, 2014) suggested that teachers need not focus on teaching the grammar within texts as an activity within a literacy and science integrative unit, but instead, "allow students to grapple with the meaning of complex sentences" (p.22). Such work, led by O'Connor, looked at how science texts are lexically dense, but provided students worthwhile struggle in digging deeper into the text to discover the “storyline” (NRC, 2014, p. 22) behind the scientific details. Because science texts are traditionally challenging for students, it became important for researchers to discuss ways that teachers could be intentional within instructional contexts about helping young readers gain access to the complex, dynamic ideas represented in these text genres.

Synergy 4. Writing. Writing as a high cognitive output is not a new topic of conversation for major researchers and theorists. Comprehension and development of metacognitive skills in reading science texts supports learning in this context, but so does writing and word development strategies. Alexander & Fox (2003) write about the type of acquired or learned knowledge and processes combined with growing innate mental capacities when a student has to write to convey knowledge of content. “The cognitive demand of writing to convey knowledge is high compared to only discussing subject matter and the literature agrees that, “… written language, which requires the manipulation of a symbolic system [is] not required in oral communication or in other problem-solving domains, such as history or biology” (Chi, Glaser, & Farr, 1988) (p.40). Research regarding practitioner knowledge for how to use writing in science class suggested using science notebooks and writing to learn activities, but also writing to communicate results and generalizations. Additionally, vocabulary work is an essential part of writing. As E.D. Hirsch (2003) noted “vocabulary knowledge correlates strongly with reading (and oral) comprehension” (p. 16). Hirsch also asserted that domain knowledge was important to understanding text, especially in comprehending text that was specific to science disciplines.

More specific than detailing the types of writing that may be taught in the science classroom, there was research that looked at the specific form of argument from the ELA standards and how it paired with science integrative content. Scientific argumentation was a primary approach to language use within existing science and literacy models suggested by current research (NRC, 2014; Hardy, Kloetzer, Moller, & Sodian (2010). The language of argumentation "…is typically defined as a process or interactions between individuals exchanging evidence to convince each other of the validity of their claims" (Lee, 2017). In relation to the integration of science and literacy, the importance of science talk became "bringing a critical stance toward ideas based on reasoning and learning to engage in scientific argumentation" (NRC, 2014). As argumentation was also specified to describe what is known and how it is known, it can become a heuristic, a valuable tool for getting language about science into the air. When this type of discourse was fostered within a collaborative community about science learning, argumentative discourse became a part of the synergies of the disciplines.

In recent years, there has been attention to how CCSS in ELA and NGSS diverge in terms of argumentation (Lee, 2017). While the CCSS in ELA standards focused on opinion writing and not argumentative writing until the middle grades, researchers argued for opportunities for the varied nature of the standards to complement one another as social processes (Lee, 2017; NRC, 2014). The premise behind this thinking was that there was promise for the future in the practice of integration by focusing on the bridges between ELA and science practices and standards.

Science and literacy integration and possible connections to middle Appalachia. Throughout the review of the literature, I provided an overview of state and national initiatives related to science literacy integration, as well as a breakdown of the major components of science literacy synergies. In order to move these ideas forward to what it means to this research, it was necessary to explore existing and possible intersections of such facets of science literacy integration with Appalachian culture.

The roll out of CCSS and NGSS occurred during a time in Appalachia when the local economies in central Appalachia suffered due to the conflict with mountain top removal and the dismantling of the coal industry. For much of time, the schools of middle Appalachia have remained on the fringe of federal education program budgets and remain high in rates of poverty, drug use, and lack of post-secondary attainment (NRC, 2014). The people of middle Appalachia, tend to extend community health through their local school system. As national efforts are beginning to surface to shed light on the dilemmas faced by Appalachian schools through programs established through agencies such as the Appalachian Regional Commission, efforts are stilted at times due to the impenetrable nature of the community and culture to outsiders. Research on Appalachian identity found that it can be described in terms of three epitomes: region, race, and language (Trout, 2015). Elevation and topography tend to be positively related to Appalachian identity as well as longevity of residence in Appalachian communities. Additionally language is an important indicator of Appalachian identity as the natural dialect of the region is declining due to negative perceptions of the Appalachian register according to non-Appalachian parts of the world (Trout, 2015).

I posit that unique findings could come from research regarding the intersection of Appalachian culture and identity with the teaching and learning of science and literacy within Appalachian elementary schools. Such work could look at inquiry in terms of the natural ecology of the geographical region and the problems faced in the region as place-based tools for the teaching and learning of science. Beginning with an understanding of cultural funds of knowledge (Gonzalez, Moll, & Armanti, 2005) students and teachers native to Appalachia might approach science tasks and content from the natural environment. Otieno & Wilder (2010) conducted research on middle schoolers in Appalachia and found that, “[i]n order to be motivated to learn mathematics and science, middle school students need to see the relevance to their lives of what they are learning and this can be structured through the investigations” (p.11). Appalachian context offers students multiple possibilities in looking at issues such as water ecology and related issues of mountaintop removal.

While there have been studies focused on urban Appalachia (Obermiller, 1996; Sullivan & Miller,1990) very little research has been conducted on synergies within models of science and literacy integration as applied to rural Appalachian schools. Such work could provide invaluable insights to how culture-based education contributes to instructional synergies between the disciplines. One current research study (Kingsolver, 2017) looked at cultural studies of science education specifically in rural Appalachian contexts and posited that Appalachia has rich cultural diversity and that there are opportunities for students in Appalachian contexts to tap into STEM based educational content through exploring ideas of social justice. Connections were made to social justice by exploring Appalachia’s involvement with The Civil Rights movement and the cause and effect relationships that are spurred by mountain top removal mining. Kingsolver (2017) also suggested that science educators in Appalachia tap into students’ sense of identity as members of Appalachian communities that are experiencing localized issues. Such work is highly relevant to science and could have the potential to boost science and literacy integration to a new level of understanding.

Chapter Summary

Within this chapter, science and literacy integrative teaching is considered from within a social constructivist lens. Specifically, I approached the study of teaching and learning in the classroom within a sociocognitive interactive model, wherein the teachers and students' cultures intersected with the various components of each discipline respectively. To provide further explanation for how integrating the respective disciplines may demonstrate synergy, or the interplay of individual ELA and science components in tandem that strengthens learning in both disciplines simultaneously, I presented exemplars of synergy in science and literacy teaching identified in the research. Additionally, I provided a review of extant literature about science and literacy teaching within Appalachian contexts. In the subsequent chapter, I delineated the methodology of the current research study.

Chapter 3. Methodology

Chapter Introduction

In this chapter, I delineated the research design, methodology, and process for data collection. I proposed a framework for data analysis that I utilized in order to answer the questions outlined in Chapter 1 and supported with a literature review in Chapter 2. Throughout this account, I leaned heavily on the viewpoint of social constructionism to drive my ideas about how theory, methodology, and methods align in ways that enable me to describe the teaching of science and literacy integration within an Appalachian, elementary school context. Specifically, I delineated the research plan to provide data that will answer the two research questions:

1. How do teachers interpret and enact science and literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Methodological Approach: Ethnography

"Those who don't live in Appalachia and don't understand it sometimes make the mistake of calling these people "hillbillies." It isn't a good word for them. They probably would prefer "Appalachians." Like anyone else, they're sensitive about words" (Rylant & Moser, 1991, p.8).

Ethnographic methodology stands naturally on the shoulders of interpretive, critical, and post-structural paradigms of thought because understanding the human perspective within societal contexts is the ultimate focus. The intent of this kind of research is to not put words into people's mouths, but instead let them speak for themselves. In my study, ethnography fits as my methodology because I strived to convey the two participants' interpretations of events while preserving mutual respect of a culture. This also applies to my descriptions of gender and teacher beliefs about student development. In the text excerpt at the beginning of this chapter Rylant and Moser (1991) referred to sensitivity with words for the Appalachian people. The aim of my writing was to communicate participants' individual stories of their experience of integrating science and literacy curriculum in Appalachia.

Ethnographic inquiry falls within a qualitative, interpretive paradigm, where the researcher is primarily concerned with meaning in context (Merriam & Tisdell, 2016). Such anthropological ideals suggested that we are all products of human society and culture. Ethnography best suits my research because the culture of teaching took place within contexts that are impacted by state and district policies, standardized curricula and assessment, as well as students' individual needs. In my field notes, expanded memos, and in final writing I strived to describe such with rich detail, but also from a respectful stance of the people and culture. As Purcell-Gates (1995) reminded us that, "…all communities have appropriate cognitive abilities, albeit different ones to fit varied life situations" (p.4) and, as such, sociocultural theory of learning comes from the perspective that "all learners are seen as members of a defined culture, and their identity with this culture determines what they will encode about the world and the ways in which they will interpret information" (Purcell-Gates, 1995, p.4).

Ethnography as a methodological approach was applicable to this study because ethnography as product and process was merged with case study methodology so that the work shifted to deeply explore a unit of analysis within cultural and social contexts. In this sense, the study was focused on aspects of culture in terms of "… the beliefs, values, and attitudes that structure the behavior patterns of a specific group of people" (Merriam & Tisdell, 2016, p. 28).

Fully aligning myself within an interpretivist paradigm of thought, my epistemological beliefs were grounded in constructionism as I strived to describe two primary grade teachers' interpretation and enactment of curriculum using the words of the participants who experienced it firsthand. Thus, I utilized ethnographic procedures and data sources to describe and explain the teaching of science and literacy integration in a particular cultural setting. Throughout this process, I continually returned to the theoretical underpinning of an interactive socio-cognitive model of science and literacy integration with a sociocultural perspective of teaching and learning within classroom contexts.

Study Design: Ethnographic Case Study

Case study design was used to conduct the research of science and literacy integration within an Appalachian context. Thus, in my research design, I utilized qualitative research procedures such as interviewing, observing, and document analysis to capture the experiences of two primary grade teachers, Denise and Philip, as they incorporated science literacy integrative curriculum into their teaching. Ethnographic case study design necessitates a focus on participants' decision-making within a contemporary, real-life context in which, "the boundaries between the phenomenon and context are not clearly evident" (Yin, 1994, p.13). In subsequent sections, I provide a detailed description of the teacher participants and information regarding the definitive boundaries of the case study.

Study participants. For this study, two elementary teachers served as the primary research participants. My choice of teacher participants was purposive in that both met particular criteria necessary to the study. Both teachers taught primary grades, both made an effort to integrate science and literacy, they taught in the same school in rural, middle Appalachia, and they were native to the Appalachian region.

Teacher 1 from Mountain Primary School: Denise. Denise is native to Southeast County and has been teaching first grade at Mountain Primary School for ten years. She taught fifth grade for one year and spent the other years in first grade. Denise was considered a teacher leader at her school in terms of bringing information about curriculum and other initiatives spurred by the state to her fellow teachers at Mountain Primary School. Because the school is small, serving approximately ninety students, prekindergarten through third grade, there is only one teacher per grade level. In order for each grade level to engage in a professional learning community, Denise worked with other first grade teachers at a nearby school, also within the same Southeast County school district. Much of the curriculum for science and literacy integration that I observed in Denise's classroom during the 2018-2019 school year was dictated by the state. Denise maintained conversations with the other first grade teachers across the district about the state curriculum and student performance on the correlated writing tasks.

Ethnographic inquiry requires thick descriptions of a culture, one that can only be acquired from the researcher spending a lot of time within the research setting. I visited Denise's classroom numerous times throughout the research study beginning in August 2018 and ending in June 2019. I observed instruction within her classroom a total of eleven sessions, for various durations of time from August 2018 to February 2019. I also conducted five semi-structured interviews and obtained over sixty photos of student work and teaching artifacts from her classroom. In addition to visits for data collection purposes, I visited Denise's classroom over twenty times during the duration of the study to eat lunch with the teacher, exchange teaching materials, or to say hello during play time. Additionally, it is important to note that I maintained a text message thread with Denise across the months to communicate about her teaching and scheduling issues. Throughout the study, Denise and her students exhibited a comfortable familiarity with my presence in their classroom and that provided me with a candid glimpse into their ways of interacting with science and literacy curriculum.

Teacher 2 from Mountain Primary School: Philip. Like Denise, Philip was a native of Southeast County. He grew up in the area and served the school system as a substitute teacher during his years attending a nearby college. It was his experience substituting that made him decide to become a teacher. Philip explained that he initially wanted to pursue a career in agriculture. He had been active in the agriculture program during his years of attendance at the local high school in Southeast County and often talked about his experience with agriculture growing up in the Appalachian Mountains. His stepfather was superintendent of the district and Philip expressed that he might be interested in pursuing a future career in administration.

Throughout the study, I strived to become a part of Philip's classroom culture. I conducted a total of eight classroom observations from August 2018 through February 2019. Almost every day, Philip's science block began at 1:30 and lasted until 2:30. However, I observed and sometimes visited without recording formal observations outside of that time frame. On a few occasions, I visited his class during the morning hours, 8:00am-11:00am, a time when he taught literacy or social studies integrated with literacy. In addition to observations, I met Philip for seven semi-structured interviews, sometimes quickly near the end of a lesson to capture as much of the momentum of teaching as possible. As I did with Denise, I maintained a text message thread to communicate with Philip and collected over sixty photos of student work and teaching artifacts from his classroom over the course of the study.

The bounded features of a case study. According to the literature about case study research, "the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions."(Yin, 1994, p.12). Additionally, once the case study reveals decision making, it also reveals how the decision to act was carried out and the end result. Case study research in this light is appropriate for this study because a central focus is looking at what decisions were made by teacher participants and what their units of study actually looked like. Robert Stake (1998) described the case that is being studied as a system. He wrote of case study research as, "its behavior is patterned. Coherence and sequence are prominent. It is common to recognize that certain features are within the system, within the boundaries of the case…." (1998, p.135). Therefore, it is necessary for me to make transparent the features that bind this case study in terms of the characteristics that both teacher participants have in common. My case study of the teaching of science and literacy integration was bounded by the following criteria.

Location. Stake (1998) described case study as a "complex entity operating within a number of contexts" (p.141). A major focus for this study is that it is physically situated in rural, middle Appalachia. Geographically speaking, the study site is isolated from more urbanized locales. As one travels along a major highway in the mountains of Western North Carolina into Eastern and Western Tennessee, several rural communities such as the one that is being studied could be accessed off a highway exit and along a curving twisting road, many times alongside rivers and steep hills. This school is one such school. I recruited two primary grade teachers within the study site, referred to in this study as Mountain Primary school, a small primary school serving students in kindergarten through third grade in Southeast County (pseudonyms), Tennessee, a state that is 44.7 percent rural (U.S. Census Bureau, 2010). According to the National Council of Educational Statistics, schools that exist in rural locations are defined as being, "…remote and difficult to access, while rural areas just outside large urban cores many have relatively easy access to a broad range of specialized goods and services typically associated with suburban and city schools" (U.S. Department of Education, 2015, p.5). Currently, 49 percent of school districts in Tennessee are located in geographically rural areas (Tennessee Rural Education Association (TNREA), n.d., n.p.). There is increasing interest in research leading to initiatives to support rural students in Tennessee as is shown through The Tennessee Rural Education Framework whitepaper: "[i]n many rural communities, they are only one generation removed from access to middle income jobs that required no post-secondary degree or certification. This dynamic has completely flipped as 80% of the jobs in our state require some type of degree or certification" (Alleman & Holly, 2013, p.3). Adding to this issue, it is suggested that school district program offerings align with the regional industry needs (Hutchins & Akos, 2013). Such alignment of programs to STEM education initiatives in the form of science literacy integration in elementary grade curricula could be viewed as a worthy endeavor. Because Southeast County is a rural school district within Tennessee, representative of like areas that make up 95 percent of the state, this school district was the ideal location to study two teaching participants implementing science and literacy teaching. Specifically, Southeast County houses eight public schools and serves approximately three thousand students in one high school, two middle schools, five elementary schools, and three pre-k schools. According to state data, Southeast County Schools have a diversity score of 0.22, which is lower than the state average of 0.27. Two large subgroups of students for this region are White and Economically Disadvantaged, with 60.8 percent of K-12 students in Southeast County participating in The National School Lunch Program (NSLP), which provides free and reduced lunch based on family income. The participation in NLSP for Southeast County is higher than the average for the state at 55.9 percent and for the greater U.S. at 52 percent. Despite the challenges faced by school populations in this region, Southeast County Schools are high achieving. This district achieved the title of 2016-2017 Tennessee Exemplary School District for overall achievement growth in TN Ready for grades 3-8.

Mountain Primary School. Specifically, the study took place in one school within Southeast County. This school, referred to as Mountain Primary School, serves approximately ninety students in prekindergarten through third grade. According to state-wide data, Mountain Primary School students score below fifty percent proficiency on standardized assessments for reading and math and perform below state averages (Public School Review, 2019). The building is aged red brick and visitors enter the school under a huge heading above the door that reads, "In God We Trust." Every morning and afternoon, the local sheriff's office mediates traffic to ensure students get into the building safely. The school is surrounded by woodland property and there are very few houses near the school itself, with the exception of several alongside the street leading to the main entrance. The student population is primarily white with little diversity. It is also important to note that the student and teaching population have remained relatively flat over five years, which indicates that not many transient populations move in and out of the school or surrounding community. Just like many other elementary schools in Tennessee, the teachers and students at Mountain Primary are working hard to close existing gaps in reading through the state-wide *Read to be Ready* initiatives. The principal of the school acknowledged a school wide focus on science as a part of the Read to Be Ready initiative for the upcoming (2018-2019) school year.

During my visits to Mountain Primary School, I endeavored to become familiar with staff other than just the teacher participants. On many occasions, I conversed with the school principal and secretary as well as other teachers in a friendly and comfortable manner. The school bustled with sounds of children and often smelled of delicious food from the cafeteria.

During one of my visits, I reflected on the feeling of comfort and acceptance within the culture of the school.

> "The school smells like brownies or some kind of dessert today. When I mentioned it to the secretary, she said that she didn't know what the cafeteria was cooking, but that I was welcome to pop my head in there and she was sure that they would give me a sample. This is a very welcoming place to visitors" (Jennings, expanded field notes, September 6, 2018)

Time. This study is unique in that it took place as a new state initiated curriculum was implemented in the schools. The timeline for this research took place summer and fall 2018 into spring 2019, a time period for school-wide focus on incorporating science into literacy as specified by the Tennessee *Read to Be Ready* initiative (TDOE, 2016). The principal first approached the two teacher participants on the final teacher work days for the 2017-18 school year so both had summer break to read about the study from the IRB documentation I provided (see Appendix Parts B-G for the specific forms used to satisfy IRB requirements). The study officially began on the initial teacher workdays for the 2018-19 school year, which would be the first year both teachers were implementing the state units of study and the textbook adoption for science standards. Additionally, it is important to note that both teachers participated in professional development about the state units of study and *Read to be Ready* expectations during the 2017-18 school year, so I collected data during a time when they actually implemented the new curriculum.

As I described in chapter two, this study took place during a state-wide initiative that promoted science and literacy integration under the *Read to Be Ready* legislation. Tennessee was also focused on efforts to improve student achievement through the national *Every Student Succeeds Act* (ESSA), under which federal monies were awarded to schools through recognized foundations (e.g. National Science Foundation and the American Association for the Advancement of Science) to youth programs and/or curricula that highlight STEM education and future work opportunities in STEM related professions. During the time of the study, Tennessee was in the first year of implementing new science standards under ESSA reform. According to The Tennessee Department of Education's (TDOE) new (2017-18) science standards, science literacy is "[e]ffective communication within a scientific context [that] requires students to apply literacy skills in reading, vocabulary, speaking and listening, and writing. Scientific information is presented in many formats with various tones and perspectives. Students must process and synthesize information effectively to generate new conclusions and ideas while avoiding the pitfalls of fallacious reasoning and bias" (p.14). As a result of the case study being conducted during a time when the state emphasized science instruction in the elementary grades, I was able to capture the teaching of state-guided curricula during the first year of adoption.

In addition to a focus on science, the state also communicated concerns about literacy assessment data that indicated stagnant literacy scores for fourth grade reading. In chapter two, I delineated the *Read to be Ready* initiative in response to fourth grade reading scores. This study was timely in that new state and local policies were impacting the two teacher participants. The 2018-19 school year was the initial year for implementation of the *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages* (TDOE, 2016) and for the new textbook adoption for science, *Inspire Science* for Tennessee published by McGraw Hill Education (2019). The year prior had been a year of communication and professional development in these initiatives for both teacher participants and I conducted the study during the first full year of implementation.

Culture. Social sciences are primarily concerned with understanding culture in order to make greater claims about social reality. According to the literature (Crotty, 1998), social constructionism postulates that researchers can utilize interpretive strategies to reveal the nature of how culture functions. In this light, culture is a mechanism of society and is largely made up of symbols that a community of people share. Research that strives to make sense of and communicate the system of symbols achieves a synthesis of underlying structures of meaning for institutions and other groups within societies. Geertz (1973) described cultural symbols as, "jewels—anything, in fact, that is disengaged from its mere actuality and used to impose meaning upon experience" (p.45). In the current ethnographic study of science literacy integration, the culture being studied is impacted by macro and micro levels: The culture of teaching within primary grades; within a rurally situated school campus and community; within socio-political influences across the state, and within the larger scope of education within the middle Appalachian region. Describing the culture according to these binding factors, helps to hone the work and make it fit into a larger scope of research about teaching in elementary grades.

The macro cultures within this research study as depicted in figure 3 are Appalachian culture and the culture of state education in relation to local educational institutions, one school particularly. There is the aspect of Appalachian culture as a macro influence that impacts the two teacher participants. Cultural markers in the data that indicated Appalachian culture included any type of reference to the people who are native to rural, middle Appalachia over a long period of time, such as across generations. Other references that indicated Appalachian culture impacted teaching practices included connections to the physical geography of the Appalachian mountains or popular customs of the region, such as canning food, managing a farm, outdoor recreation such as hunting or fishing. The state educational system is also looked at within this

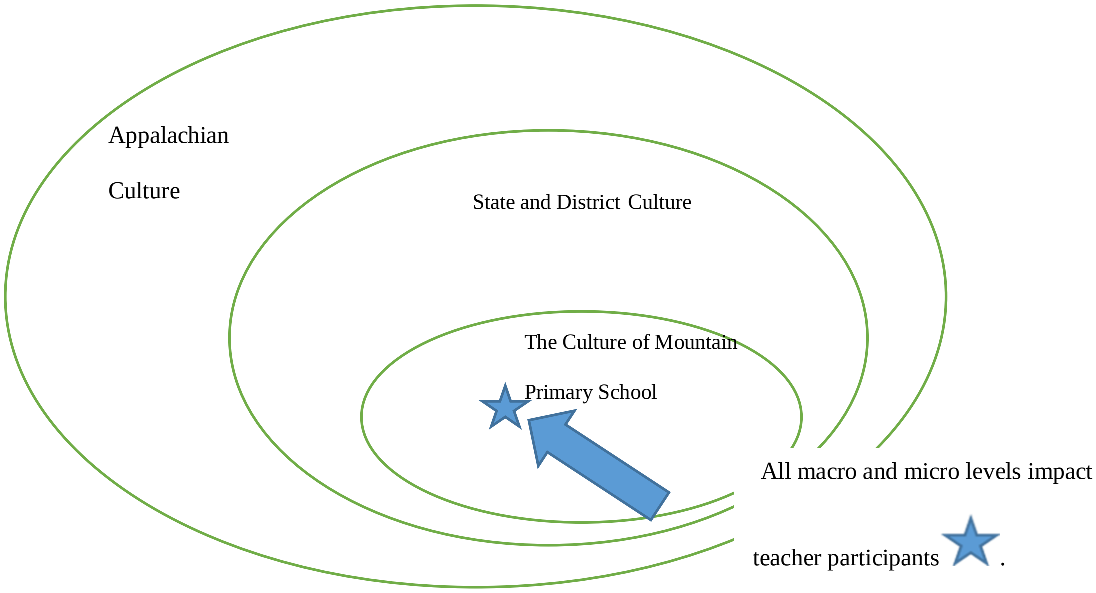


Figure 3 : The Intersection Macro and Micro Level Cultures

study as a macro culture in terms of how curricular endeavors are experienced by teachers and how teachers feel about professional development or following state-guided curriculum as a part of their instructional activities.

Micro levels of culture within this study include the culture within the school building and classroom. I strived to describe the culture of the school and classroom in ways that show similarities and patterns between the two teacher participants as well as the interactions and atmosphere between each individual teacher and his/her classroom of students. It was also my intent to describe the decisions teachers made about how to follow curriculum or create curriculum and how they felt about how the instruction progressed over time. Another indicator for micro levels of classroom culture was evidence for mood or emotion between teachers and students. I also looked at teacher interpretations of student work during and after teaching science and literacy integrative curriculum to describe evidence of cultural impacts from the data.

***Grade level*.** Both teacher participants instructed within the same school but in two different grade levels. Denise taught in a first grade classroom and Philip in a second grade classroom. Because these are primary grades, it is relatively new for science curriculum to constitute such a targeted content focus. Historically, under The *No Child Left Behind* legislation, the focus was only math and reading. Primary grades were targeted under the Tennessee *Read to be Ready* initiative as an effort to impact change on current lagging fourth grade assessment performance. In English Language Arts standards, first and second grades focused on reading literature and nonfiction texts with a goal of understanding key details that support overall comprehension of the text. However, because readers at these grade levels are still considered emergent readers based on grade level proficiency standards, there is also focus on foundational reading development, which considers underlying skills such as decoding of words through phonics-based instruction. In the science standards, the expectation is for students to develop a curiosity about science through hands on investigation. A particular focus within the context of grade level boundedness for the study is how teacher participants found balance in teaching literacy and science integration in a manner that blends skill-based with knowledge-based competencies.

***Curriculum*.** The science and literacy integrative curricula used in the study by both teacher participants included the state funded and promoted units of study entitled, *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages* (TDOE, 2016) and *Inspire Science* for Tennessee published by McGraw Hill Education (2019), the textbook adopted by Mountain Primary School. The curriculum was important to the case study because the teacher participants were in their first full year of using both the state standards and new textbook as their primary instruction for integrating literacy and science. Therefore, I have established the curriculum as a binding factor in defining the parameters of the case. Throughout the study, the teacher participants described their teaching and planning according to the two curricula components. When they were observed creating their own lessons or lesson components outside of the *TN Unit Starters* and *Inspire Science* curriculum, patterns emerged that enabled me to generate implications about the intersection of policy and teacher autonomy. Because the *TN Unit Starters* and *Inspire Science* curricula are both so crucial to this particular case study of science and literacy, in the next sections I provide descriptions of both curricula.

***Teaching Literacy in Tennessee: K-3 Unit Starters*.** In response to decreases in reading proficiency as indicated through summative testing, TN leaders put into place the *Read to be Ready* initiative, which focuses on building a network of support to teachers and students in grades K-3 to support early literacy. According to the TDOE Office of Research and Strategy (2017), "[m]ost teachers are not intentionally selecting texts around topics to build students' knowledge and vocabulary…." (p. 6). Additionally, according to classroom observations around the state, reading consultants observed that "[t]eachers are generally not using strong question sequences or asking students to complete rigorous tasks that integrate the state standards and build students' comprehension" (p.6). Both text selection (text sets around a science topic) and related question sequences were thus provided for teachers within the *TN Unit Starter* lesson sequences. The *TN Unit Starters* were published on the TDOE website and the move to provide extensive professional development through a state-wide coaching and reading consulting network began. TDOE provided professional learning modules to support teachers' implementation of the curriculum. According to a Power Point file available on the TDOE website, “A K-3 Literacy Unit Starter is a set of instructional materials that includes texts, question sequences, and tasks. The materials are purposefully designed for literacy instruction that develops knowledge of concepts related to grade level content area standards” (n.p.).

In my observation of both teacher participants, I noted that the instructional sequences of the unit starters typically consisted of the teacher reading aloud a picture book related to the science topic and incorporating guided question sequences throughout the read aloud. Then, teachers typically directed students to complete a writing task in response to the reading. In the study, I observed Denise teaching two unit starters and I observed Philip using one unit starter. Both teachers incorporated the work of the unit starter into their science and literacy integrative framework and felt that the literacy suggestions within the unit helped them successfully integrate literacy in a productive manner with the science topic. Individual teacher interpretations of the curriculum are more fully presented as part of the data analysis in chapter four. Additionally, important to note is that a statement in the curriculum by the TN DOE authors indicate the state curriculum is missing the hands-on inquiry component necessary for true integration of ELA with science, “though strong connections are made to the science standards within the unit, it is critical to note that this Unit Starter does not encompass the totality of the identified science standards. The unit is not intended to replace instruction and hands-on application of the science standards and practices” (TDOE, 2017, p.4). However, despite the message from the state that hands-on science should be a part of integration, this study demonstrated that teachers didn’t necessarily incorporate that component into their instruction.

Tennessee Inspire Science Program. This curriculum was purchased by Mountain Primary School as a textbook adoption to address the newly adopted 2017 science standards. After hosting an interview with a reading coach consultant and an English Language Arts consultant from the Tennessee Department of Education, I learned that textbook adoption can be individual for schools and districts in the state of Tennessee, so the curriculum varied among individual Local Educational Agencies (LEA). Upon investigation of first and second grade teacher edition manuals, I learned that the curriculum is characterized by key features of the STEM movement to include alignment to Tennessee's science standards, a focus on science practices, and a series of lessons that are organized by the 5E Learning Model (Bybee, 2006). The pacing of the program occurred over ten days of instruction for forty five-minute teaching blocks. Lessons usually began with a science probe (Keeley, 2008) to assess understanding of a science concept, then progressed to incorporating short videos and other technology applications to spur collaborative thinking and discussion about the science topic. An essential question was posed and students then moved into hands on inquiry, a time where they experienced first-hand science investigation and recorded their observations and findings in a science journal. Reading and writing activities occurred in the explain and elaborate E phases after hands-on inquiry and finally students were assessed in the evaluate stage. All of the student writing and recording of information in investigations happened in the student journal, also provided as a component of the textbook series.

Data Collection Methods

It was important in this study for the data collection methods to match the intent of understanding each individual teacher's interpretations of integrating science and literacy and documenting what teaching actually occurred within the individual contexts. In this section I address the following: 1) the time line of data collection, 2) types of data that were collected, 3) rationale for data that were collected, and 4) rationale for how data were collected.

Timeline. Data collection began in August 2018, prior to the students' first day of school. I conducted interviews with both teacher participants during one of the initial teacher workdays for the start of the 2018-19 academic school year and I visited classrooms for non-participant observations from August 2018 and into February 2019. I developed expanded field notes about classroom instruction, and interviewed teacher participants candidly and spontaneously during and after the instruction and planning for the unit. All of the work done by the teacher in science and literacy integration was studied in progress across the duration of seven months into the school year. For more information regarding specific observations and interviews conducted I provide several figures in the Appendices, Part J. Observation Records through Appendices, Part M, Interview Records.

Data source 1: teacher interviews. My assumptions were that the verbal interaction of the interview process allowed me to form insights based on participants' commentary. This research was focused on understanding the teacher's interpretation of science and literacy integrative teaching so a focal data source was information gleaned through interviews. I captured this information through audio recording and later transcribed and analyzed for patterns and themes. Additionally, as impromptu, candid conversations take place with the teachers during and immediately following instruction, the interactions were recorded in like manner or through field notes. The discursive interview is a valuable research technique in conducting ethnographic investigation. Prior to the interview, the researcher organizes the guiding research questions in an effort to focus the data collection (DeMarrais, 2004). In several cases, I asked interview questions candidly at moments of pause during times when the teacher was circulating the room or facilitating independent student work and at other times there was designated time for me to sit down with participants to host more thorough, semi-structured interviews.

During the study, I conducted seven total interviews with Philip and five with Denise. For an overview of interview topics and focus please refer to the Appendices, Part IV: Data Time Frame, B. From the two guiding research questions, I created sub-categories of interview guide questions (see Appendices, Part III: Data Collection Tools. However, at times given the nature of candid conversation and semi-structured interviews, I would respond to a teacher's direction of thought and ask new questions. Agee (2009) wrote that developing qualitative research questions is a reflective process and the researcher must be prepared to veer from the original guide as the ultimate guide for production of knowledge is the research participant. Qualitative interviewing provides an open-ended, in depth exploration of an aspect of the life about which the interviewee has substantial experience and considerable insight. In this light, the interview can elicit views of the teacher participants' subjective world. From engaging in interviews with the teacher participants, it was my goal to create an outline of the participants' views by delineating the topics and drafting the questions. According to Pezalla, Pettigrew, and Miller-Day (2012), when using interviewing as a data collection method, the purpose is to "elicit detailed narratives from respondents depending on the perceived sensitivity of the topic, but … variation in the interviewer characteristics may benefit rather than detract from the goals of team-based qualitative inquiry" (p.165). Subsequently, it is important to note that my interview guide was semi-structured, so that I used the questions for reference, but I aimed to remain flexible in my interview questions so that I could take the interview participant's lead if we needed to go in a different direction. Since the goal was to situate myself from the teacher's perspective, it was necessary for me to respect what he or she considered important in relaying information about science and literacy teaching. In the Appendices, Part H, Interview Protocol for Teachers, I documented all questions and displayed the correlation to the original research questions.

As I analyzed interview data, I initially looked for categories of information that could be associated with science and literacy as respective disciplines and for descriptions for how the disciplines intersected in classroom instruction. Additionally, I also strived to realize categories of information that related to Appalachian culture and/or issues of rural contexts, classroom and/or school contexts, and individual notions of culture based on place and/or people. A figure displaying interview transcription data with corresponding coding analysis and analytic memoing is offered in the Appendices, Parts N-O, Coding Charts for Observational and Interview Data.

Data source 2: classroom observations. Given that my second research question is contingent upon the enactment of teaching, observing active instruction was a crucial method for data collection. Subsequently, I participated in eleven non-participant observations in Denise's classroom and eight in Philip's throughout the year of study (see Appendices, Parts J-K: Observational Records for Philip and Denise). Gobo & Molle (2017) wrote that "when observing actions, ethnographers should focus on three aspects simultaneously present in social settings: social structures, the common-sense interpretations/explanations given by participants in their talk, and the context of the action" (p.178). For each observation, I first double checked the time and date with each teacher via a group text. After making sure both participants were expecting me, I entered the classroom quietly and settled myself at a table or desk area located at the outer perimeter of the classroom, but close enough so that I could hear and see everything occurring. I preferred to type my observations on my laptop, but there were a few times that I took handwritten field notes during observations. I focused my notes by first noting the characteristics of the setting. I explicitly noted the physical environment of the classroom-- the wall coverings, the desk groupings, and/or any visible evidence of ongoing instruction. I offered a sample field template and an example of one observational recording of notes as an example data source in Appendices, Parts I-J. I also strived to capture the teaching activity and physical positions of teacher and students. Additionally, I considered the mood of the atmosphere and attempted to capture bits and pieces of discourse between students and teacher verbatim.

During and after each observation, I took detailed field notes and created memos to self. My assumptions were that observed student and teacher behavior may provide insights on internal thought processes. After each observation, I expanded my notes in an effort to remain cognizant of indicators of meaning related to deeper themes that were occurring in relation to classroom instruction and teacher interpretations. But, I also added separate analytic memos at the bottom of my field notes to capture my reflexive thoughts. I wrote my perceptions, questions, and thoughts in a separate area on the field notes document or often times on a separate document altogether in an effort to keep my thinking separate from the activity and indicators of interpretations of the teacher participant. I also collected photos of teaching artifacts that correlated with the activity being observed as another data source.

Qualitative researchers strive to develop a multifaceted picture of the scenario under study. This involves reporting multiple perspectives, identifying the features involved in a circumstance, and generally sketching the larger picture that emerges. In this work, I noted and described positionalities or roles and the interactions among the actors. Environmental stimuli, as well as evidence of individual and collective perspectives of teachers and students were captured in field notes as well as the talk that took place among students and teacher during active teaching sessions. As I analyzed observational data and expanded field notes after observations, I bracketed information that related to the research questions. Data from observational field notes was coded according to the type of observed teaching in the lesson, but it was also used to analyze some of the language between the teacher and students in an effort to discern any connections with the first research question regarding teacher perceptions. Language was also analyzed for cultural markers for Appalachia in terms of observed use of colloquialisms and storytelling. A figure displaying observational field notes data with corresponding coding analysis and analytic memoing is offered in the Appendices, Part N. Coding Chart for Observational Field Notes.

Data source 3: document analysis. Based on the premise that documents created and used in the course of the research constitutes unobtrusive data that could provide important information about the social workings of science and literacy teaching without interfering in the act of science and literacy teaching, I collected artifacts of student work and teaching each time that I observed. The teacher and students were so accustomed to me observing, it was a natural occurrence for me to take photos with my cell phone of teacher made charts, science lab materials, student pages in science notebooks, student and teacher writing samples, or other pieces of paper related to the work that was taking place in the classroom during active instruction. Many times during instruction, students would bring their work over to me in order for me to capture a photo and the teacher would direct me to capture images during occurrences when a particular science experiment or literacy work was going really well. During document analysis, which I describe in more detail in subsequent chapters, I organized all documents by inventory of contents. Student writing or evidence of thinking, teaching materials, technology use were several categories that documents were correspondingly organized into and then analyzed in tandem to the interview and observational data that I collected during the same time frame. Additionally, photos of student work samples were used to prompt teacher discourse during semi-structured interview sessions. After collecting each artifact of student work, I stored a hard copy of each document in each participant's corresponding folder alongside copies of classroom observation field notes and interview transcripts.

Data Analysis Procedures

Timeline. Data analysis often occurred in tandem with data collection because in moments of observation I analyzed what I saw and heard and captured my thinking in expanded field notes. Many times, I would leave verbal memos of reflection about my observations on a digital audio recorder. As I conducted final analysis, I listened to the verbal memos to cross check the audio notes alongside my notes regarding codes and categories. Formal analysis began in November 2018 and continued through February 2019.

Inductive analysis. Merriam & Tisdell (2016) write that oftentimes, researchers are spurred to begin research because a theoretical framework doesn't encompass all aspects of an occurring phenomenon in the field. Therefore, the researcher must build the case of rich description and analysis through the collection of data, exposition of related theoretical frameworks, and from gleaned observations and interactions in the field. Specifically, this work of thinking inductively is described as, "…moving from specific raw data to abstract categories and concepts" (Merriam & Tisdell, 2016, p. 18). After collecting data from interviews, observations, and documents I noted overlapping and discordant information and created codes to reflect these categories. Codes were approached as identifiable units of information and linked together to make broader statements about the two teacher participants and the teaching that was taking place in each of their classrooms.

Phase 1: coding. Complex reasoning through inductive logic takes place in the data analysis process. Qualitative researchers build their patterns, categories, and themes from the "bottom up," by organizing the data inductively into increasingly more abstract units of information. Saldaña (2016) reminds us that, "…a theme is an outcome of coding, categorization, and analytic reflection…." (p.198). I applied three cycles of coding to my data bank of observation field notes, interview transcriptions, and document analysis. Throughout each coding cycle, I worked back and forth between the categories of information and unifying themes collected on a database until I was able to unite several themes across the experience of studying the two teacher participants across their teaching of three units. I would also like to add that I member-checked with the participants interactively, through interview questions that invited them to talk about my initial themes and big categories of thought about the data. I also provided some copies of transcribed interview data so that both participants could clarify the information I had highlighted in my analysis of categories.

Saldaña (2016) wrote of inductive reasoning through the data analysis stage of research, "some methodologists advise that your choice of coding method(s) and even a provisional list of codes should be determined beforehand (deductive) to harmonize with your study's conceptual framework, paradigm, or research goals" (p.75). In this study, I kept my research questions in the forefront of the codes:

1) How do teachers interpret and enact science and literacy integration?
2) In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Therefore, in vivo coding for categories and themes related to participants' interpretation of events was a necessary cycle to work through. In addition to in vivo coding, I completed a cycle of process coding to track how the teaching progressed to address the second part of the first research question that focuses on describing the enactment of teaching. A third cycle of descriptive coding was applied to all data pieces- interviews and documents, including field notes, expanded field notes, and all photos of student work and activity in the classroom.

Finally, I applied Axial coding in order to link categories of information together and arrive at overarching themes. I describe my coding and analysis processes below.

Coding cycle 1: In vivo codes. Saldaña (2009) describes using in vivo coding from interview transcripts, "as a method of attuning yourself to participant perspectives and actions" (p.73). Throughout the course of the study, I prioritized the importance of the experiences and interpretations of the teacher participants. Therefore, in vivo coding provided a useful mechanism for me to highlight the voices of my participants, by using their exact words for initial codes. I began by going through the transcripts and interviews and highlighting actual words and phrases spoken by the participants to describe their opinion about something or an emotion that was experienced. These are a couple of in vivo codes from Denise's interview: "I was a little bit hesitant about that at the beginning and still am a little bit because I think that is a long time for such small children"; "that sounds easy but it's very difficult because they want to draw what they want to be there and so we're trying to focus on reality, I guess, of getting them to understand". From these interview excerpts, I used codes such as hesitant and difficult to capture Denise's feelings about the work. In vivo codes from Philip's interviews included: "I like science anyway, so I try to teach it" (Philip, personal communication, August 18). From a later interview I highlighted this excerpt in the in vivo coding cycle, "I mean, I use it a lot. I think that it's very helpful to me. It includes a lot of online things and you have to know how to use the online website to pull up videos and things like that. It helps me teach" (Philip, personal communication, January 7). From these two excerpts from interviews, I coded likes science and helpful technology. I attempted to note participant language that gave insights into teachers' interpretations and that answered my research questions.

Coding cycle 2: process codes. The second part of the research question in this study is concerned with describing the instruction or classroom practices in the two individual teacher's classrooms, or how classroom instruction is enacted. Saldaña (2016) wrote of process coding as a means of describing the dynamics of the story of events. Therefore, it was necessary for me to read through and highlight statements of action and discussion about events that happened in transcriptions of interviews. I looked for gerunds, (-ing) words to label actual and conceptual actions of the two teacher participants. I also analyzed photographs I took during active classroom instruction and evidence of student work to categorize instructional acts according to how the science and literacy disciplines worked together to create a cohesive lesson within a unit of study that took place over subsequent time. In looking back at the literature on science and literacy integration, the concept of synergy appeared critical to understanding the interplay of literacy with hands-on science inquiry (Cervetti, et. al., 2007). I examined teaching artifacts and teacher commentary and categorized both as evidence of synergy or, in other words, I examined how the integration of two distinct disciplines (ELA and science) may result in different, challenging but accessible pedagogy (science and literacy integration). I remained focused on how each teacher's instruction demonstrated a unique synergy that was highly impacted by policy-driven curriculum. I revisit the topic of synergy in chapter 5 and discuss the implications for professional development in considering synergy as a means for professional learning for teachers. One example of process coding that led into describing the synergy in Denise's instruction is presented below:

> "It is bringing a lot more literature into my science. Before I was pulling science into the literature, if that makes sense. And now, it is more of a focus on the science itself and

> pulling the literature into it. So, it is kind of a better balance" (Denise, personal communication, November 29, 2018).

From the above excerpt, my process code was a label for "balancing literacy and science." Denise expressed her views about how the state curriculum, the *TN Unit Starters* approached science and literacy disciplines in terms of standards. She recognized that there was a shift in terms of the emphasis on science. For her, it was a shift to focus on a science standard first and then weave in reading and writing according to the science standard. Likewise, an example of a process code, "planning for literacy and science" was pulled from Philip's interview data and categorized as "teacher interpretation of synergy of ELA and science standards":

> When you're planning your science maybe if it's science and life cycles, point to different life cycles of maybe like a bear or a fish, amphibian. You could pull in that and then when I compare and contrast standards and say 'okay, we're going to read these two books on two different animals and I want you to compare and contrast these two'. So, always just try to find the content first and then think about the literacy standards (Philip, interview communication, August 28, 2018).

Similar to Denise, Philip expressed his viewpoint that when planning for science and literacy integration, he first turned to the science standard for guidance. Thereafter, he chose texts and looked at the ELA standards for the activity. In this particular excerpt, he referred to the literacy skill of compare and contrast as the activity. In later sections, I described other versions of synergy applied in both teacher's classroom instruction. After processing codes were applied, it helped me realize the sequence of planning and instructional activities and begin building categories of information that eventually led me to realize my themes. Themes derived from coding are presented in more detail in chapter four.

Coding cycle 3: descriptive codes. Descriptive codes condense an excerpt from the data corpus into a key word or phrase (Saldaña, 2009). Descriptive coding is particularly useful when applied to observational field notes and documents and provides a detailed inventory of their contents (Saldaña, 2009). After completing the cycles of in vivo and procedural coding, I moved into the task of descriptive coding. I applied the method of descriptive coding to all collected data including interview transcripts, observation field notes, and documents. Qualitative inquiry is dependent on rich descriptions of events the researcher experienced. I constantly returned to my observational data and photos to describe what the instruction looked like. I went through each piece of observational data and transcriptions line by line. When I came across passages dealing with topics that I believed to be important to my two research questions, I noted the descriptive words in a key word or phrase. I recorded each descriptive in the margin of the corresponding passage. This is an example of a passage from Philip's interview in which he discussed his interpretation of how reading about the science content helped build background knowledge and boost vocabulary development:

> We read a read-aloud together, a science read-aloud, "Fun in the Rainforest." And in it, there were a couple different vocabulary words like gills, lungs, and survive. And that gave them a background on how different body parts helped certain animals survive-what they need to survive (Philip, interview communication, September 6, 2018).

In the margin beside Philip's passage I wrote the descriptive code, "reading that boosts science vocabulary". Another descriptive code from Philip's interview data was coded as "teacher interpretation of synergy of reading to support science."

I think that science and literacy happen together. First you show a video to pique their interest and then you bring in a text for a read aloud. Then you need to have the hands on experiment. The writing then comes after that. To show they understand (Philip, interview communication, November 29, 2018).

I also applied descriptive coding to images and artifacts as a detailed inventory of their contents. Many images looked like the image in figure 6, showing an image of a picture book written about a science topic, one of many used by teachers to read aloud to their students. The *TN Unit Starters* curriculum was focused primarily on literacy; the primary method for positioning text within the curriculum was through teacher read aloud of complex text, sometimes returning to a text to read aloud a second time.

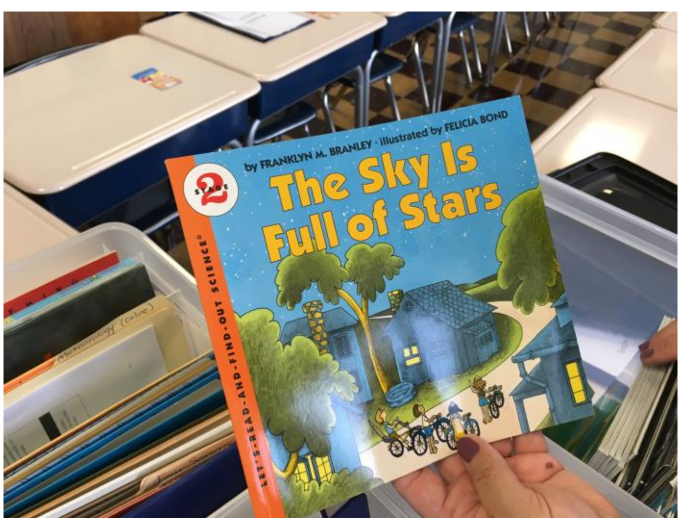


Figure 4: A Picture Book from the TN Unit Starters Curriculum

Many of the picture books were used by the teacher participants such as the one in Figure 4. The texts were purchased with school funds for both classroom teachers to use in their implementation of the *TN Unit Starters.* After reading aloud the text, both teacher participants were observed guiding their students in a writing task in response to the reading. Images such as this one was coded descriptively as "teacher read aloud text". Descriptive coding was attached to all photos taken during classroom observations to unpack the pertinent details of each image. Throughout the coding process I organized photos according to the classroom in which they were taken; phase of teaching shown in the video; whether the image was a teaching artifact such as a textbook or image of a specific type of curriculum used in planning; images of active teaching activities; and student work samples. The images were printed and arranged in a binder during the data analysis process. From the descriptive codes and categories, I used the images to create descriptions of the major themes in the study presented in chapter four.

Descriptive codes were assigned to all science content topics, genres of texts used, format for reading the texts in classrooms, formats for writing activities, and types of science activities. Reading aloud was the primary format for sharing texts with students, but other instances of shared reading experiences that involved the students working with individual copies of text were observed as well. Writing activities were mostly coded as a response to reading aloud, writing to record experiences in a science investigation, or writing to demonstrate competencies in narrative, informational, and opinion writing. Writing tasks included prompts from the *TN Unit Starters* curriculum.

Coding cycle 4: axial coding. The fourth and final cycle of coding I conducted was that of axial coding. Strauss & Corbin (1998) wrote of axial coding that it is rebuilding the fragments of data that were split up during the coding and categorization process to reveal the properties and dimensions of an event. To accomplish axial coding, I read through existing categories of information among all documents and combined subcategories based on how the information was related. Codes from interview data, photos, and documents, and field observation notes were combined to form a description of science and literacy instruction across the study duration within both teacher participants' classrooms. For instance, in Denise's data codes from the data correlated heavily on her work following the *TN Unit Starters* curriculum. "reading aloud" and "writing task" codes eventually fit within the category of "following state guided curriculum" and leading to a thematic analysis that policy and choice impact how science and literacy integration is carried out. It also impacts the synergies of the disciplines within integration contexts. Thus, the dominant curriculum favored the ELA components over the hands-on inquiry. As a result, there was less hands-on inquiry that occurred in classroom instruction while the teacher participant followed state-guided curriculum.

Phase 2: analytic memos. Saldaña (2009) posited that analytic memo writing is a "critical component of Axial Coding" (p.161). This type of writing connects the story of the research project from the category to theme analysis by considering deeper aspects of events that occurred and teacher thinking as evidenced in interview interaction. As I completed coding cycles for each participant's data set, I would write my thoughts and reflections in my researcher's journal. The writing was informal, many times in bulleted list form, and often addressed a direct reaction to a code I had created for that participant. For instance, one code that stood out to me within the Appalachian culture category was "stories". An analytic memo I created related to stories included,

- Older generation indicates longevity being embedded in culture
- Links the science to place (telling stories within the community)
- Indicates a teaching style of a teacher who is native to middle, rural Appalachia (shares background experiences to make connections to content and teachers background experience with language sharing/communicating through storytelling narratives)
- Links communication of information to storytelling
- Sometimes includes telling stories about self

The analytic memoing process provided a means to build bridges from codes into categories of information about how Appalachian culture impacts teacher interpretations and enactment of science literacy teaching. From this memoing, evidence of culture was realized in how teachers in middle, rural Appalachia communicate with students around science content that is explained or elaborated on by references to experiences that are unique to Appalachia. For instance, in the interview excerpt below, Denise shared a story from her past with her students to help them grasp the concept of The Big Dipper star.

> And I told them a story…my granny had a dipper at the sink when I was growing up. It always hung there and everybody that came through just drank out of that. It's just gross now, but they thought that was just fascinating that she had a dipper (Denise, interview communication, November 29, 2018).

Throughout data analysis and moving from codes, to categories, into themes, I continually returned to my research questions and theoretical foundation to double check the alignment of categories. In one such example, the code "stories" was pulled from several data sources including the excerpt above. The codes eventually aligned into categorical groups of information describing storytelling as a teaching act and a way of identification of self. Eventually, this analysis led to the thematic development of "culture is prevalent in science and literacy integration." This theme is discussed in more detail in the next chapter alongside other excerpts of data that reinforce data analysis descriptions.

Phase 3: moving from codes to categories and beyond. After completing the three cycles of coding with all pieces of data, I began to consider which codes might fit together into categories or beginning patterns. Having completed Axial coding in the final phase of coding helped me to realize how patterns overlapped to result in two main themes within the data. 1) state policy and teachers' enactment of science and literacy integration intersect but do not align completely; 2) place-based culture can influence science and literacy integration; 3) ways to make science and literacy integration more effective. Initial coding for participant interpretations and for describing the acts of teaching and the decisions of both participants in following state guided curriculum or incorporating their own were linked together by categories of information related to state guided curriculum and/or statements about feelings or interpretations. I continually addressed the two research questions as I linked codes with categories to arrive at patterns and overarching themes in the work.

1. How do two primary grade teachers interpret and enact science literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Additionally, the second research question was addressed through data analysis as initial coding procedures provided information related to culture in the teaching of literacy and science in Appalachia. I first analyzed data in terms of words or phrases that are associated with Appalachian history, physical geography, people, and ways of communicating with language. Words such as “rural”, “farming”, “gardening”, and “stories” were extricated from the data. Initial coding procedures led me to realize categories for how culture presented in the teaching of science and literacy integration. Major categories for how that took place was through 1) discourse during teaching; 2) interpretations about people; and 3) place based teaching actions. The two teachers both expressed information about how Appalachian culture permeated their work in the classroom. Categories relating to teachers referring to local geography, recounting teaching experiences, recalling lived experiences in local community, connecting instruction to local people, geography, connecting instruction to students' experiences with local people or geography eventually led to the theme of “place-based culture can influence science and literacy integration”. Specific examples of data to support thematic representation are presented in chapter four in more detail.

Chapter Summary

In this chapter I provided a description for the qualitative data methods employed as I studied the two teacher participants. I outlined data collection methods of gathering interview data and observational field notes. Additionally, I described that I collected photos of teaching and student work samples to analyze alongside my ongoing field notes and memo writing in my researcher's journal. Data analysis included conducting four coding cycles focused on answering the two research questions:

1. How do two primary grade teachers interpret and enact science literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

The next chapter details the two individual thematic descriptions of teacher interpretations derived from data analysis procedures and links them to the research questions. Connections are also provided to the sociocognitive framework that views the variable nature of teachers' and students' individual experiences and backgrounds and how that overlaps with the nature of the text or task being used in instruction and the impact of both on the culture and level of learning that takes place in the classroom environment (Ruddell & Unrau, 2004).

Chapter 4. Analysis

"In the summer many of the women like to can. It seems their season. They sit on the kitchen chairs on back porches and they talk of their lives while they snap beans or cut up cucumbers for pickling. It is a good way of them to catch up on things and to have time together…. In the winter many of the men like to hunt and this seems their season. They take off into the woods together…."(Rylant & Moser, 1991, p.11)

Chapter Introduction

Given the romantic description of Rylant's and Moser's (1991) description above of traditional gender roles in Appalachia, we are left with an image of a harmonious way of life in rural, middle Appalachia. However, the literature suggests that in contemporary times, Appalachia is much more complicated. Given current realities, research indicates that Appalachia is increasingly complex and that a generic Appalachian experience or perspective should not be assumed in the research (Kingsolver, 2017). However, the practical realities of rural, middle Appalachia includes the realization that there is an existing achievement gap in education and that many communities in the area have struggling economies with the highest rates of working poverty (Ray, 2007). The purpose of this study was to investigate and describe science and literacy integrative teaching in two classrooms within a primary school located in rural, middle Appalachia in order to understand more about how cross-disciplinary teaching and curricula is interpreted by teachers and enacted in classroom instruction.

The research design used in the study was ethnographic case study design. This design fit best because the research is linked to what Stake (1998) described as the conception of ethnographic case studies as they:

> need accurate description and subjective, yet disciplined, interpretation; a respect and curiosity for culturally different perceptions of phenomena; and empathic representation of local settings—all blending (perhaps clumped) within a constructivist epistemology (p.149).

And through ethnographic data collection methods of semi-structured interviewing, conducting non-participant observations of active classroom teaching, and collecting photos of student writing and teaching artifacts I immersed myself into the micro cultures of Mountain Primary school and Denise's and Philip's respective classrooms.

Thus, through the theoretical lens of a sociocognitive framework and a sociocultural view of the classroom and community, I strived to answer both research questions: 1) How do two primary grade teachers interpret and enact science and literacy integration?, and 2) In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?. The sociocognitive interactive model (Ruddell & Unrau, 2004) as theoretical underpinning was helpful in my study as the teacher participants were considered as actors in a specific cultural context within their individual classrooms. Based on this model, the overlapping areas between the teacher, students, classroom environment, and type of text used in a teaching scenario impacts the level of understanding that is achieved as a result of the teaching. The teacher's and the students' background experiences, current knowledge, and cultural lenses with which they viewed the world were always considered alongside the nature of the text and teaching interactions. Additionally, it is important to note that text in this study was defined as any hard copy or digital text, writing assignment, or hands-on science investigation. I consciously considered the interaction of text, teacher, and students in each teaching and learning situation that I observed in order to ascertain deeper patterns in the data.

Using ethnographic case study design, I collected data samples from hosting interviews with the two participants, and conducted nonparticipant observations while taking field notes during moments of active classroom instruction. Additionally, I took photos of teaching artifacts and student work. During analysis procedures, triangulation, a strategy noted in the field as helping to authenticate the reliability of an ethnographic study (Gobo & Molle, 2017) was utilized. Subsequently, I presented segments and excerpts of raw data from all the data sources in an effort to demonstrate reliability for the findings. Interview, observation excerpts, as well as various images of documents are presented throughout this chapter of analysis as a reflexive narrative, a manner of portraying the data analysis as a journey to the intersection of accurately portraying individual teacher interpretations while being transparent with my theoretical interests, methodological notes, knowledge of the literature, and previous experiences and interests in science and literacy integration in elementary schools. After an inductive, reiterative process for data analysis, I arrived at two over-arching themes in the study:

- State-guided curricula and teachers' enactment of science and literacy integration intersect but do not align completely.
- Place-based culture influences teacher interpretation and enactment of science and literacy integration.

An example progression from codes, to patterns and categories, leading to thematic identification is provided in table 1 below.

Figure 5 depicts the progression of coding to thematic development from data analysis. The chapter is organized by each thematic analysis primarily with references back to Figure 5to support individual findings that are traced through the process of coding, categorization, pattern development, and then back to the over-arching theme. Each finding, presented in Figure 6 below is then presented according to each of the two teacher participants' individual experiences.

As displayed in Figure 6, there were seven findings in this case study. I organized the findings according to their correlation with the over-arching theme within the data and strived to triangulate the findings across the three main forms of data- interview discourse, observational field notes data, and document analysis. Additionally, there were data samples retrieved from personal text message and email communication.

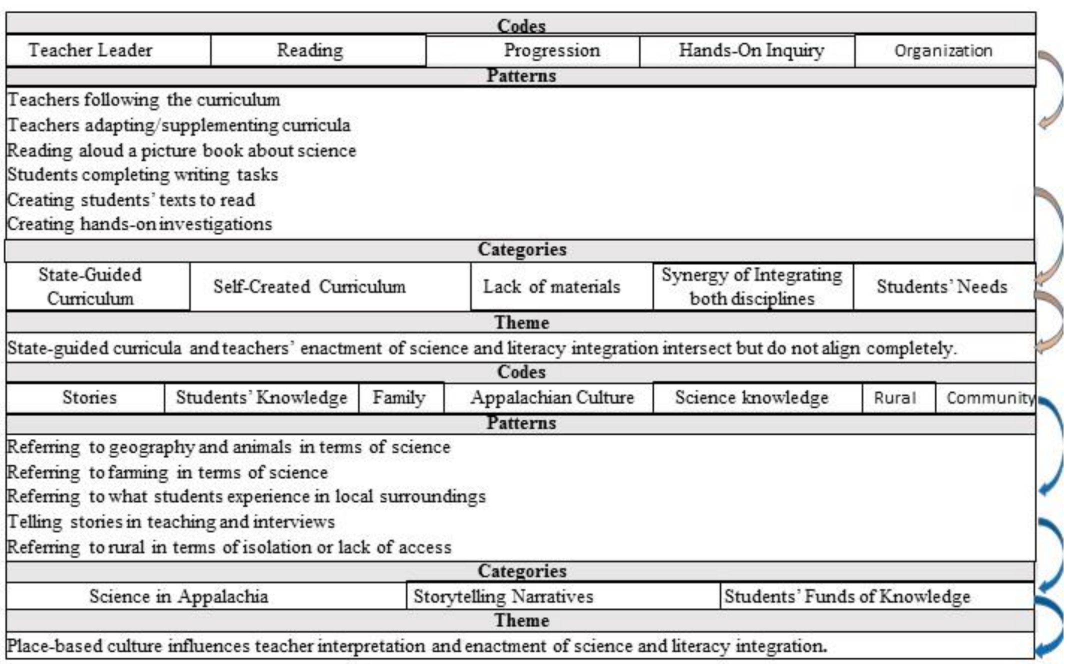


Figure 5: Progression of Codes, Categories, and Themes

Theme 1: State-guided curricula and teachers' enactment of science and literacy integration intersect but do not align completely.
Finding 1: Both teacher participants followed the state-guided curriculum and believed the movement to incorporate more science on the part of the state was a move in the right direction to benefit students.
Evidence 1. Interview data: snippets of discourse about following curricula
Evidence 2. Observational data: observations of teaching lessons from state-guided curricula
Evidence 3. Artifact data: photos of teaching artifacts from student writing, reading, and/or science investigations
Finding 2: As a result of following the curriculum, teacher participants realized gaps and supplemented the curriculum in ways to meet the students' developmental needs.
Evidence 1. Interview data: snippets of discourse about gaps in the curricula; creating components of curricula
Evidence 2. Observational data: observations of teaching that utilized self-created components
Evidence 3. Artifact data: photos of self-created components of teaching and curricula
Finding 3: As a result of following the curriculum, teacher participants realized gaps and supplemented/adapted the curriculum in ways that demonstrated teacher knowledge and beliefs about the interactions of the individual disciplines of science and literacy within their teaching.
Evidence 1. Interview data: snippets of discourse about teaching all aspects of science and literacy integration (hands-on inquiry, discourse, writing, and reading)
Evidence 2. Observational data: observations of lessons that involved all aspects of science and literacy integration (hands-on inquiry, discourse, writing, and reading)
Evidence 3. Artifact data: photos of teaching artifacts that correlated with hands-on inquiry, discourse, writing, and reading
Finding 4: Teachers experienced tension in science and literacy disciplinary integration, particularly in whether to privilege text or hands-on inquiry in their instruction.
Evidence 1. Interview data: snippets of discourse about the individual components of science and literacy integration (hands-on inquiry, discourse, writing, and reading)
Evidence 2. Observational data: field notes of lessons regarding areas of emphasis related to the individual components of science and literacy integration (hands-on inquiry, discourse, writing, and reading)
Evidence 3. Artifact data: photos of teaching artifacts representing hands-on inquiry, discourse, writing, and reading across time
Finding 5: Teachers learned through implementation of new curricula in ways that enhanced their teaching practice and they submitted substantive ways to improve disciplinary integration.
Evidence 1. Interview data: snippets of discourse in reflection of a previous lesson; snippets of discourse in reflection over student writing
Evidence 2. Observational data: observations of lessons with self-created components
Evidence 3. Artifact data: photos of teaching artifacts that were self-created
Theme 2: Place-based culture influences teacher interpretation and enactment of science and literacy integration.
Finding 6: Teachers associated place-based culture with science and conveyed such through storytelling narratives about themselves as cultural insiders to rural, middle Appalachia.
Evidence 1. Interview data: snippets of discourse that addressed a cultural marker of Appalachia-culture, geography, local people across generations, religion, customs, discourse
Evidence 2. Observational data: observations of teaching lessons that incorporated discourse indicative of a specific culture; observing connections with culture in teaching actions and talk (references to any cultural markers of rural, middle Appalachia during teaching)
Evidence 3. Artifact data: photos of texts used for reading, student writing, hands-on investigations materials
Finding 7: Teachers as cultural insiders, shared cultural understandings with students and drew upon this knowledge to integrate science and literacy.
Evidence 1. Interview data: snippets of discourse that made a connection to a cultural marker of Appalachia-culture, geography, local people across generations, religion, customs, discourse
Evidence 2. Observational data: observations of interactions between teacher and students in relation to a cultural marker of rural, middle Appalachia connected with science
Evidence 3. Artifact data: photos of teaching artifacts from student writing, reading, and/or science investigations

Figure 6: Findings Correlated with Themes

Theme One: State-guided Curricula and Teachers' Enactment of Science and Literacy Integration Intersect but do not Align Completely.

A binding feature in this case study is the presence of state-guided curriculum. Both teacher participants utilized two primary curricula, *Inspire Science* and the *Teaching Literacy in TN Unit Starters* to carry out their science and literacy integrative teaching. The research context included the presence of state-guided curricula and the impact on the teaching efforts in science and literacy integration, therefore a finding was that teachers followed the curricula.

Finding one. Both teacher participants followed the state-guided curriculum and believed the movement to incorporate more science on the part of the state was a move in the right direction to benefit students. In this section I described both teachers' instruction and provided details for how data collection and analysis helped me to look deeper into each participant's experience with science and literacy integration. There were apparent patterns in the data that led to the formation of a theme that both teachers followed the curriculum but experienced tensions and needed to adapt or supplement the curricula in various ways. Philip and Denise started at different points, but through their experiences with the complementary curricula, one that privileged learning science through literacy and the other through investigations, they both managed to develop the kind of synergistic instruction according to the NSTA definition including, "doing, talking, reading, and writing," from within, "hands-on science activities along with secondhand text investigations" (Shapiro, 2006, n.p.).

***Denise*.** During the 2018-19 school year, Denise's instruction was greatly impacted by curriculum designed and promoted by the state.

> Anything science to me is just the most hands-on, most interactive, and useful thing to teach them. Because you can do experiments, you can do something pretty much with all of

it…you just can't get as much active involvement and hands-on stuff with the other subjects like science and I think they love that. And, it teaches them more. So, I try to find ways to incorporate, but science is just the best at incorporating things (Denise, interview communication, January 7, 2019).

Because the 2018-2019 school year marked the first year of full implementation of the *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages (TN Unit Starters)*, Denise planned accordingly and carried out the *Teaching Literacy in Tennessee: Unit Starter Grade Kindergarten ELA Unit Connected to Earth Science* in her classroom instruction at the beginning of the study. She expressed to me in an interview that she was happy about the movement in the state to increase the focus on science.

Science has always been on the backburner. They have also been focused on reading and math. It's there but it's never been a big push. From the time I started and it has gradually started becoming more. And the [teachers at nearby school] and I, to get the science in, we are, I mean, it's kind of like we've been doing this for a while. But, we would take whatever our reading story was for the week and we would pick whichever science was in that and we would incorporate it because we would do whatever the topic was for that week (Denise, interview communication, August 2018).

From August to December 2018, she followed *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages*. Initially, she expressed her feelings about the curriculum in terms of how it was organized and merged with her instructional plan.

typically they're three weeks, which I was a little bit hesitant about that at the beginning and still am a little bit because I think that is a long time for such small children. The way they have it laid out is interesting. It builds. So, this year our kindergarten didn't do it last year so

> I am going to have to do it again, which is fine. But, it starts out with like seasons and weather and that type of thing. Once I get done with that it goes into like day and night sky, how the sun warms the earth, and gets into the rotation, and the planets, and all of that kind of stuff (Denise, interview communication, August 13, 2018).

Primarily, the science concepts Denise described was taught through reading aloud picture books. Typically, she would meet her whole class at the brightly colored carpet in her classroom. They would sit on the carpet at her knees, while she read and displayed the text. She described in an interview her interpretations about how to follow the curriculum and the worthiness of the text complexity factor of the texts she would read aloud to her students:

> I can just pull out the folder and I will have exactly what I need to do my questions and the book together. It makes it a whole lot easier. The units tell you the day and about the sequence, the questioning. It has what text to use. It tells you the level of the book so you don't have to go find that kind of thing. It tells you how complex the text is. It has qualitative and quantitative. No letter. Text structure, meaning, purpose, knowledge demands—it tells you exactly how the book hits what they need (Denise, interview communication, August 13, 2018).

Denise sometimes merged her work with the *TN Unit Starters* with her dedicated literacy block, where the students moved among small groups to practice literacy skills and engage in activities. She described in an interview how the *TN Unit Starter* curriculum would factor into her regular literacy block.

> After reading it a few times I remember where the questions are. We just read the books. I use the writing task as my independent writing group. Typically what I do is whole group and then we split into small groups. I have four small groups they rotate through. This is my

writing center (depicted in figure 7, below) (Denise, interview communication, August 13, 2018):

Denise described her work in an interview about merging the writing task from the *TN Unit Starters* curriculum with the small group format, including the writing center specifically:

> I would have a topic/prompt that went, well it would be this task and that's what they would write about in their writing center. The problem came with this in that you had to have your individual reading time and I had to get the grammar and phonics skills. So, how do you get the grammar and phonics skills? So normally, that's where I sit [gesturing to a back table] and we read and that's where we do the reading to get this done. That's my small group reading (Denise, interview communication, August 13, 2018).

Figure 7: A Small Group Writing Center

I observed in Denise's classroom to watch how the instructional activities progressed, and wrote about the sequence of events during the literacy block:

> The teacher is sitting on grey and white ottoman, looking at her students sitting on the rug in front of her. She finished the book, *Thunderboomer,* and props it up on the shelf. Students break into centers. The screen on the SMART TV reads:
>
> Text to Self

- Have you ever been in a storm?
- What type of storm was it?
- What did you see, feel, or hear?

> Some children (two boys at the moment, but I think they will rotate) have wide-ruled notebook paper and they are writing at their desk. I will take a picture with my phone in a few minutes. Two students are working at the word work center on a making words worksheet. The classroom is a buzz of activity and talk. Teacher is working with five students at the kidney table and it appears they are talking about possessive nouns. The teaching assistant is working with a small group of three students on a response to the reading about storms. They are reading about storms and characteristics of storms. The writing is a personal response to the story *Thunderboomer* and students are writing that they would invite their neighbor inside out of the storm (Jennings, expanded field notes, August 30, 2018).

An example writing sample from my observation is depicted in figure eight, below. Over the course of the study, I captured images of student writing in Denise's classroom during rotating small groups like on August 30, 2018 and during other lessons that were conducted as a whole group read aloud and writing task. In figure 8, the writing sample is a personal response to the story that was read aloud that depicted characters caught in a fictional storm. Other writing tasks

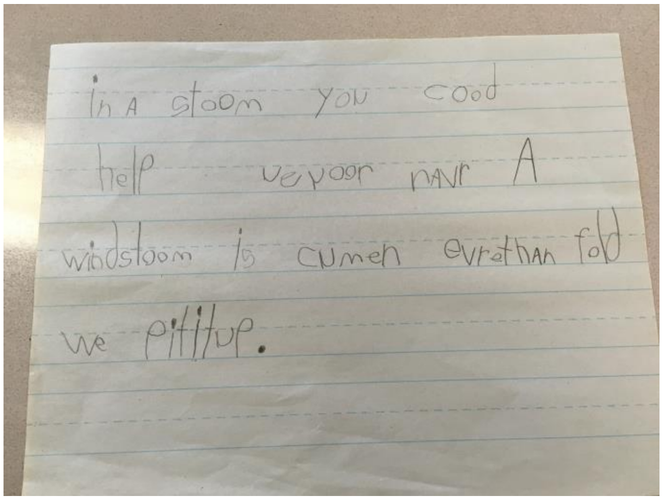


Figure 8: A Student Response to Reading Sample

that students completed in Denise's lessons included informational writing to explain the processes of scientific phenomenon and writing to record information gleaned during a hands-on science investigation.

Denise described how she envisioned her work with earth science would go in terms of the texts she used for reading. Even though the primary teaching of science occurred through reading, she described the teaching according to the science topic or phenomenon. For instance, she described units of teaching in terms of weather, day and night, seasons, and light. In this case, the progression of the unit in terms of the science standards for first grade required students to describe patterns of day and night and link it to seasonal patterns on Earth. She described the unit of teaching in terms of how the texts convey the science ideas, as in the quote below:

> The books start progressing I think the next couple are more into the seasons, and then we'll get into describing the attributes of the different seasons and making sure they know the order of the seasons. And then it progresses. We start getting into what makes the seasons

> change and so we'll start getting into the sky, you know the sun, the moon, that type of thing and that flows straight into the first grade unit which is all about the sky, wind, space (Denise, interview communication, August 30, 2018).

Her teaching in the kindergarten unit took approximately one month. Following that unit, Denise moved into *Teaching Literacy in TN Unit Starter Grade One ELA Unit Connected to Earth Science* for twelve lessons. Denise followed the same format as in the kindergarten unit, beginning with reading aloud a complex picture book connected to the science standard and asking the designated questions sequences to spur conversation about the topic with her students. As a culminating task for each lesson, her students completed a writing task. Writing tasks within this unit included creation of diagrams and models with labels to provide information about the earth, sun, and moon relationships and patterns.

After Denise finished the *Teaching Literacy in Tennessee: Unit Starter Grade Kindergarten ELA Unit Connected to Earth Science*, she looked through the student writing samples that were collected from the unit as summative assessment and discussed them during an interview:

> Well, they were able to read about how it works, and then pull in the science part of seeing, and they were able to understand, I guess the pattern and concept more. They drew it and were able to explain how it worked rather than just reading it from a book. So I like that about it….and a lot of them could tell me, but their drawings are not all that wonderful. Like this one, didn't make it dark, but they did write the word "night' and the word "day" and they drew arrows, so they understood that one side (Denise, interview communication, November 29, 2018).

What is significant about the above excerpt is that it shows Denise's interpretation of the level of student understanding and level of effectiveness of teaching within the unit.

She believed that knowledge of day and night and seasonal patterns were displayed by the students’ ability to draw and label the movement of the Earth in relation to the sun, by the use of non-fiction text features such as arrows to show movement, accurate illustration (shading of dark and light in appropriate areas), and correct labeling of seasons, day, night, and other associated vocabulary (as is shown in figure 9).

In December 2018, she created a short unit on animals that primarily followed the same format as the *TN Unit Starters*. Content was delivered through reading and writing only:

> I pulled this one—our story in *Journeys*, which is our basal—*Animal Groups*. It is talking about classifying them, so they know the five animal groups. I have books that I’ve pulled that go along with that, like *Whose Tail is This?* I’ve got one on *Edward the Emu* and yesterday we read *Biggest, Strongest, Fastest* So everyday I’ve pulled one that has to do with animal parts and we’ve just kind of built on that this week (Denise, interview communication, November 29, 2018).

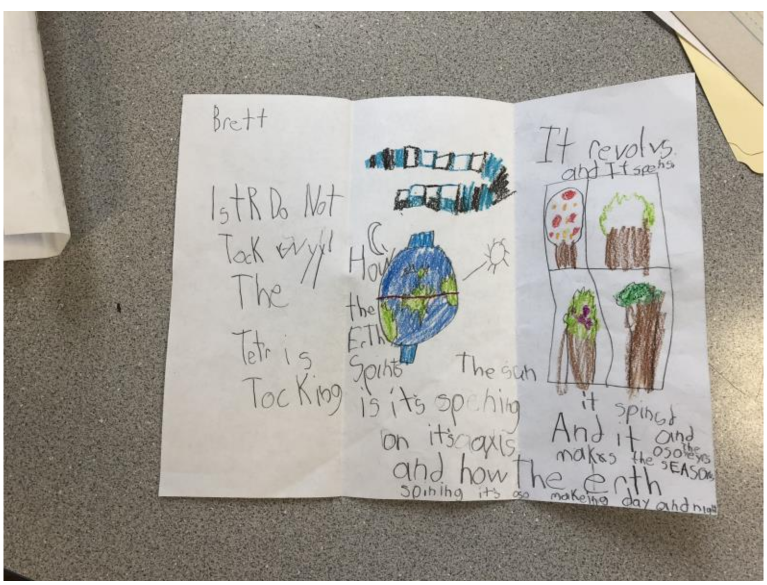


Figure 9: A Student Informational Writing Sample

The teaching in the lessons within the animal unit looked very similar to the *TN Unit Starters* in that the science was primarily taught through reading, writing, and drawing/labeling. I wrote about a lesson during a nonparticipant observation in November:

> The teacher joins the students at the carpet. She displays the book, *What Do you Do with a Tail Like This?* There is a discussion about the front cover. The teacher asks, "do you think it is a lizard or a chameleon? What do you think it is?" Various students call out what they think. She opens up the front and back cover and it shows a type of lizard. The teacher says, "it looks kind of like an iguana to me. On the front of this book, can we tell if it is fiction or non-fiction?" A student says, "no, you can't tell yet because it gives you information, but you can't tell if it is telling a story." The teacher says, "we need to investigate a little further. The main thing is that we have been learning about how animals use their body parts in different ways to help them live. This book is about this too. What is our story in our reading books?" The students respond, "*Animal Groups*" The teacher says, "this goes right along with it too. This is showing what part [refers to a fish face on the page]. If it is a fish, what does it use its eyes for? What would it use its mouth for?" The kids all call out, "to eat and to see." Teacher is gesturing toward each of the illustrations of the animals. The teacher then connects to another text they read about elephant mothers hugging their young. There is a discussion about lizards' tails that breaks off and then grow back. There is a discussion of a scorpion using its tail for protection and a monkey's tail to hang from tree to tree. There is a discussion about animal eyes and how the eagle can see things from high in the sky and the chameleon can move their eyes in many different directions. After reading the text, the teacher introduces a worksheet that is formatted like a CLOZE sheet with a missing word for the animal and how it uses its body to survive. She is

going to write names of animals on the board for students to refer to as they write (Jennings, expanded field notes, November 29, 2018)

After the animal unit, from January to February, 2019, Denise used segments of *Inspire Science* and created her own units of study focused on science standards for properties of light. It is important to note that Denise created some components and omitted several activities prompted by the curriculum. She felt that many of the student writing activities in the *Inspire Science* student notebook were unnecessary and a waste of school funds to purchase such a strict guided format for writing (Jennings, expanded field notes, February 2019). What's interesting to note about Denise's teaching during this unit is that she followed a similar format as the *TN Unit Starters*, reading many informational and fictional picture books related to the topic of properties of light. She asked similar text-dependent questions during reading and guided students to respond to reading in a culminating writing task of varying formats. But, different from the unit starters, she began integrating hands-on science investigations, some of which she adopted or adapted from *Inspire Science*, but others she found by doing her own research in other curricular materials and online.

Within this unit, students wrote (see figure 11) about observations of shining flashlights into mirrors, or how objects appeared when they were taped to the back of a soda bottle full of water dyed with food coloring depicted in figure 10.

As students conducted the investigation, they completed a lab recording sheet that Denise created. She created many of her own science lab recording sheets and even readapted the lab recording sheets in order to suit her students' needs.

Figure 10: A Teaching Artifact for Hands-on Inquiry

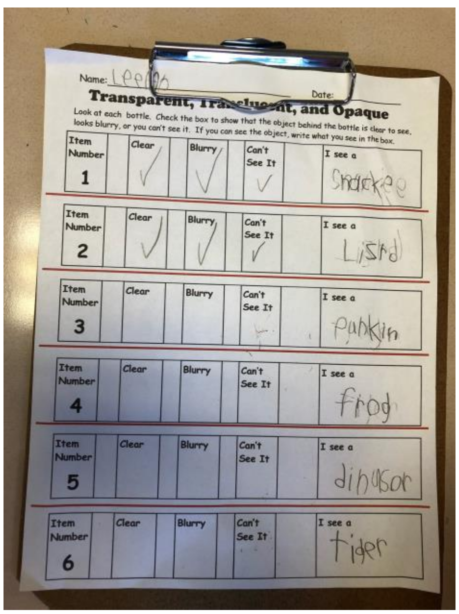
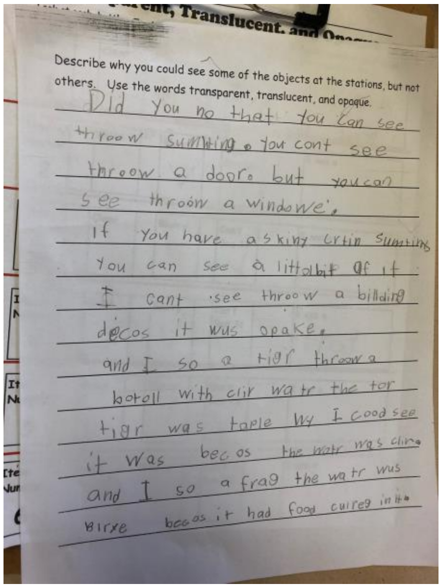


Figure 11: A Student Lab Sheet


Describe why you could see some of the objects at the stations, but not others. Use the words transparent, translucent, and opaque.

Did you no that you can see throow summting. You cont see throow a door. but you can see throow a windowe.

If you have a skiny crtin sumting you can see a littolbit of it.

I cant see throow a billding becos it wus opake.

and I so a tigr throow a botoll with clir watr the tor tigr was taple wy I cood see it was becos the watr was clir.

and I so a frag the watr wus birxe becos it had food cuireg in the

Figure 12: A Student Informational Writing Sample Post Hands-on Inquiry

Contrary to previous units with an emphasis on literacy, in these lessons she mixed reading and writing with hands-on investigation and technology (see figure 10 through figure 12). She described the unit in an interview:

> I think this unit flowed very well. It was building on the concept as it progressed. It fit well after the Universe unit. We learned what the sun did and how it worked. Then moved into the energy we get from the sun. We were able to relate and draw from that unit to show explanation or similarities with what we had already learned. It was very interesting and therefore engaging. The hands-on component increased their engagement and interest. There was a combination of genres on the same topic. It required recall, critical thinking/processing, and expressing thoughts and ideas well (Denise, interview communication, January 7, 2019).

There were a few big patterns in Denise's data upon my analysis. Despite following a policy, Denise demonstrated autonomy in several ways. She made decisions about pacing, which grade level curriculum to use, texts that were read, formats for student writing tasks, use of technology and experiences with hands-on inquiry. Denise shifted from following state-guided curriculum that focused heavily on reading aloud of texts and students' writing tasks to combining reading aloud and learning about science through first-hand investigations.

Philip. Philip explained that science was always a part of his curriculum even before the district and state policies emphasized it. He attributed this to his interest in agriculture. He wrote a grant during the previous academic school year to obtain a greenhouse.

> I end up teaching more science than social studies. So, anyway this past summer I did go to a professional development on agriculture (AG) in the classroom. So, me coming from an AG background, I was president of Future Farmers of America (FFA) in highschool. And I was all in agriculture and everything…I even go a grant last year from Farm Bureau and I don't know if you can see it outside my classroom, but I built a greenhouse and it sits on the playground (Philip, interview communication, August 13, 2018).

During the fall 2018, he accompanied his students on one of Mountain Primary's yellow school buses to the nearby high school so that his students could gather various plants grown in the Agriculture department of the high school to raffle off for Mountain Primary's fall festival. Beyond the scope of the study, Philip also planned to lead his students in growing seeds for a plant unit in spring 2019 and continue the partnership with agriculture students at the high school in growing and maintaining a school garden project.

Like Denise, Philip was considered a teacher leader for bringing professional development about the new 2017-2018 science standards from the state department to his school.

As part of this work, Philip attended professional development at Southeast County district office and served as a teacher representative for nominating a science textbook adopted by all schools in the district. The resulting decision was to adopt *Inspire Science*. For the majority of the study, August to December 2018, Philip followed the *Inspire Science* curriculum. He focused on life science standards for the majority of the study. At the onset of the study he followed the *Inspire* Science curriculum for second grade, module 1: *Living Things*. Four lessons within the unit occurred during observational sessions: *Parts of Animals*, *Classify Animals*, *Life Cycles of Animals*, *Living Things and Their Parents*. Philip also followed the curriculum for the module entitled, *Habitats*. Within that module, Philip taught two lessons, entitled as, *Living Things in Habitats* and *Changing Habitats.*

He guided the students through hands-on investigations with periodic writing-to-learn activities. I described his teaching in expanded field notes during an observation of his instruction in August, 2018:

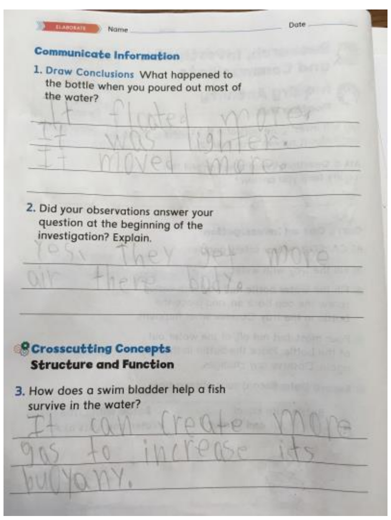
> There are four clusters of desks; desks arranged in groups of four. The lesson title is floating fish. Teacher starts out with question. On each table students have a booklet where they write their questions. The question today is 'why do fish float?' There is a tub of water on each cluster of desks. Learning goals are written across the board Science- I can use evidence to describe how animals use their body parts in different ways (2.LS1). Students write the essential question in their notebooks. The teacher hands them a plastic bottle with liquid inside. Students observe the bottle floating in the tub of water, then write about their observations in their notebooks. Students pour out liquid and repeat the same test of the bottle to describe how the floating changed. Teacher distributed an article and students

underlined evidence to prove how fish float. (Jennings, expanded field notes, August 28, 2018).

I also collected photos of teaching artifacts and student writing within each lesson. For the particular lesson in August about animal characteristics, figure 13 depicted the floating bottle investigation and figure 14, a page of student writing from the *Inspire Science* student notebook.

Philip followed the Inspire Science curriculum across the duration of the study. He designated the final hour of each instructional day as the science block and utilized that time period to follow the *Inspire Science* curriculum. During the literacy block at an earlier time in the instructional day, he would utilize a text from the basal anthology, if the text had a connection with the science concept, or he would create texts from online articles, or utilize electronic texts to work with students in reading. During the months of September and October, 2018, he utilized the *Teaching Literacy in Tennessee Unit Starters* because he felt it aligned with the work he was doing in *Inspire Science* and addressing TN science standards. During Philip's literacy block, he offered many reading lessons around the same or similar life science content that he addressed at the end of the day in his science block. However, there were times he was observed utilizing non-related texts and genres during his literacy block and then just continued with science in the afternoon because he viewed the literacy block as a designated time for reading in all content areas (not just science) and a time to address competencies in foundational skills for reading in second grade as well as working with fictional style literature non-related to science. During the October to December time period, Philip incorporated the *TN Unit Starters* curriculum into his reading block. He discussed it in an interview:

Figure 13: A Hands-on Science Investigation



ELABORATE Name Date

Communicate Information

1. Draw Conclusions What happened to the bottle when you poured out most of the water?

It floted more. It was lighter. It moved more.

2. Did your observations answer your question at the beginning of the investigation? Explain.

Yes, they got more air there body.

Crosscutting Concepts
Structure and Function

3. How does a swim bladder help a fish survive in the water?

It can create more gas to increase its bucyany.

Figure 14: A Sample Notebook Entry from Inspire Science Curriculum

I have started on my Tennessee state unit for reading and its life science based. It's on animal life cycles. So that's what I'll be doing today. They do a lot of writing with it. They have a prompt they have to answer. So, basically, we'll do a read aloud together. I've done the read aloud this morning, I'll review a little bit this evening before they write. We do a read aloud together, and I question them throughout the read aloud. Then, they write about it. Most of them have been informational writings so far. Today, they're going to be doing a speech like they're a scientist and they're giving a speech to a group of children who just came to the zoo to see butterflies in their life cycle. (Philip, interview communication, October 18, 2018).

Philip's teaching across the study largely was enacted from the guidance of both standardized curricula provided by the state. He first began with *Inspire Science*, and after a few weeks, started the *TN Unit Starter*s and focused his morning literacy block on the read aloud of picture books about a life science topic with corresponding writing tasks. Meanwhile in the afternoons during the science block he continued to follow the *Inspire Science* curriculum. When he finished with the *TN Unit Starters*, he used the basal anthology and online resources to use for reading instruction not related to science.

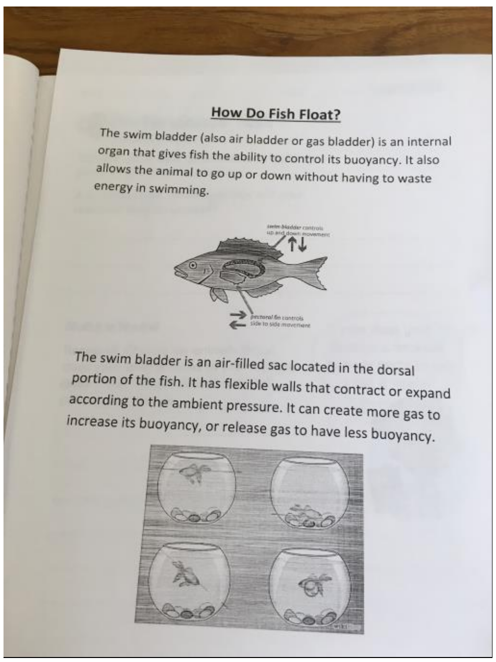
Finding two. As a result of following the curriculum, teacher participants realized gaps and supplemented the curriculum in ways to meet the students' developmental needs. Through these experiences teachers noticed the gaps in curriculum disciplinary components, in particularly in literacy. Both teachers considered it a good move on the part of the state, the teachers embraced the new curriculum, but tensions arose because the curriculum in its entirety wasn't sufficient to use with primary grade students. For primary grade teachers, there is a constant tension between writing and reading to learn and learning to read and write because the students are emergent readers and writers. In this case study, teachers acknowledged gaps in curriculum for foundational literacy skills; supports for leveled readers for small group work aligned with science topics; and a lack of alignment of the books they had with the science topic. There was also a tension present in terms of truly integrating science and literacy.

***Denise*.** Throughout the study, Denise considered the curricula in terms of whether or not it met her students' academic needs. Because she knew her first graders had not experienced instruction within the kindergarten *TN Unit Starter* curriculum, she chose to implement it in the onset of the study. Denise felt it was appropriate to begin work in the kindergarten unit starter because the science topics from weather and seasons seemed to flow into the first grade science focus on day and night and patterns in the sun, moon, Earth systems (Jennings, expanded field notes, August 13, 2018). She also realized that many of her students were on the younger side of the age spectrum for first grade and needed support in the foundational skills for reading in terms of work with phonics, word recognition, and grammar skills. She discussed the gap in foundational skills work in an interview:

> Whether it be an old book you are using, you have to find it yourself, make it yourself. It is not a fully comprehensive and that has been my issue with it all along. Is them saying, 'we want you to do nothing but this, and not use the basal.' Now they are going back and saying we can use the basal. But, it is not progressive. It's here, there, and yonder. And it doesn't go from short-vowel, long-vowel, you know, so you have to have something else to carry that part through (Denise, interview communication, January 7, 2019).

Therefore, she arranged many of the *TN Unit Starter* lessons into a small center format where students could travel among centers to complete literacy tasks. Often this would involve Denise reading aloud the picture book associated with science from the *TN Unit Starter* curriculum, asking the question sequences during reading to prompt discourse, and then guiding students to move among centers to complete the associated writing task as well as work on foundational reading skills with her guidance and the help of her teacher's assistant.

Philip. It is also important to note that Philip found supplemental texts in the school library to use with the textbook curriculum and he self-created texts for shared reading experiences from online articles. He created (figure 15) and located texts primarily because the state couldn't afford to purchase additional texts for small group reading that were suggested in the *Inspire Science* curriculum.



How Do Fish Float?

The swim bladder (also air bladder or gas bladder) is an internal organ that gives fish the ability to control its buoyancy. It also allows the animal to go up or down without having to waste energy in swimming.

The swim bladder is an air-filled sac located in the dorsal portion of the fish. It has flexible walls that contract or expand according to the ambient pressure. It can create more gas to increase its buoyancy, or release gas to have less buoyancy.

Figure 15: A Teacher-created Text for Reading Instruction

In November 2018, he moved away from *Inspire Science* to follow *Teaching Literacy in Tennessee: Unit Starter Grade 2 ELA Unit Connected to Life Science (TN Unit Starters)* with a focus on animal life cycles. During this time period he read aloud the texts suggested by the curriculum and guided students in the corresponding writing tasks during the morning literacy block and merged hands-on science investigation from *Inspire Science* in the afternoon science block.

> I think they're [TDOE] going to decide whether they want to stick with the basal or spend money on actual texts. I think they're trying to go toward the [*TN] Units* more. I mean, I like both. The basal makes it easier, just because kids have their own copy. But, with the units, it would take way too much money to be able to buy a book for every kid. So, really it's just about doing read alouds. Which is good in a way, and it helps kids get ready. Helps them answer questions to you. But, they don't have something they can read in front of them…that's a downside to it (Philip, interview communication, September 13, 2018).

In January 2019, he continued work in *Inspire Science* with animal habitats but substituted worms instead of pill bugs and created his own student science notebooks.

Finding three. As a result of following the curriculum, teacher participants realized gaps and supplemented/adapted the curriculum in ways that demonstrated teacher knowledge and beliefs about the interactions of the individual disciplines of science and literacy within their teaching. This case study captures ways that state-guided curriculum, *Teaching Literacy in Tennessee K-3 Unit Starter Professional Learning Packages* (TDOE, 2016) and *Inspire Science* for Tennessee (McGraw Hill Education, 2019) intersected with teachers' instructional choices. Specifically, I looked at the components of instruction for science and literacy integrative teaching identified by the NSTA definition:

> Integrating science and literacy involves learning through firsthand investigation or hands-on science activities, along with secondhand text investigations. This approach requires learning through multiple modalities: doing, talking, reading, and writing (Shapiro, 2006, n.p.).

As I worked through coding cycles for interview transcripts, observational field notes, and document analysis of student work and teaching artifacts, I continually revisited my list for what constituted the key indicators of synergy, or constituent parts of the NSTA definition for science and literacy integration and I searched for the indicators in all data sources. Within interview data segments I presented excerpts that addressed one or more of the following categories:

- statements about the standards for both science and ELA
- statements about order of the disciplines
- statements about individual disciplines of science and literacy within the lesson context
- statements about the progression of a lesson or unit
- statements about how the lesson/unit impacts students' active engagement

Additional data segments were presented in the forms of observational field notes as expanded field notes as well as photographs of student writing samples and teaching artifacts. In order to address the first research question that focused on describing the *enactment* of science and literacy integration, I presented segments of observation depicting a moment in the sequence of events or the progression of instructional activities within a lesson. I also aligned the segments of observation to the major components of science and literacy integrative curriculum as identified in the literature: reading, writing, discourse, and hands-on inquiry. Additionally, I presented a photo taken during instructional activity to provide a clearer depiction of events.

Denise**.** Initially in the study, Denise followed the *TN Unit Starters* curriculum and primarily taught science through the reading. She discussed her work within the unit starters:

> Because the science book that they [state/district] just bought, the science material and the science standards were the basis for these units. So, they actually made the units to go with

> the science standards. So, we are actually teaching them in science to get the unit with the science together (Denise, interview communication, September 6, 2018).

She followed the curriculum in its layout for literacy and described it in an interview:

> Daily task one. So, it goes, it tells you about the text you will be reading and all of that. Then it goes over here and gives you vocabulary and questions and it gives you an example of what to do. This is deeper from what we had last year, just the writing task. This year, they put more of this thing in, so when I did it last year, it was almost at the end of every one where you just write about something. And then at the very end of the year, it was a four square to draw the four seasons. But this time, they are putting more specific things in there" (Denise, interview communication, September 6, 2018)

Denise's interpretation of the interplay between literacy disciplines with science was one indicative of reading, talking, and writing to explain a common science phenomenon, in this case in the kindergarten TN Unit Starter, it was writing to accurately describe seasons and associated weather patterns. She also referred to the texts as each conveyed the information of science content:

> The books start progressing. I think the next couple are more into the seasons and we'll get into the describing the attributes of the different seasons and making sure they know the order of the seasons. And then it progresses, we start getting into what makes the seasons. Why they change and so we'll start getting into the sky, you know the sun, the moon and that type of thing. It flows straight into the first grade unit which is all about the sky, wind, and space. (Denise, interview communication, August 30, 2018).

After Denise concluded the first two unit starters and carried out a small self-created unit about animal characteristics, she self-created a unit around the topic of light. What is interesting to note about this unit is that Denise demonstrated a shift in terms of how the literacy components worked in tandem with science. She described connecting the lessons about light to previous work in the TN Unit Starters with day and night patterns:

> Look at the photo of the sun. What would you observe about the sun and the sky? And it has a picture. Well, we were already writing about what we observed from the unit, like what causes shadows to change? That's kind of like a little experiment, and we did some stuff outside with shadows changing. You know, just like standing (Denise, interview communication, January 7, 2019).

In observing Denise's teaching in January through February, 2019 I noticed that small group centers were still being incorporated, but instead of literacy work, the students were engaging in individual science stations such as using flash-lights and mirrors to investigate light reflection. The writing was observational in nature as students traveled to each center, investigated a property of light, and wrote about their observations (Jennings, expanded field notes, January 17, 2019). Such a shift demonstrated an awareness of individual components for each discipline in science and literacy teaching. In Denise's situation, I observed a gradually increasing presence for hands-on inquiry across the study with primarily a continued major emphasis in literacy.

Philip. Throughout the study, Philip used *Inspire Science* curriculum to carry out his science and literacy integrative instruction. At the onset of the study, Philip described how he planned to follow the curriculum:

> This year will be different from the past two years since I've been here because we just got a new science curriculum, a new textbook. I will base most of my instruction along with that text. I mean, I'll pull other books in to work with too (Philip, interview communication, August 13, 2018)

He described the various ways texts appeared within the lessons:

> We read a read aloud together, a science read aloud, “Fun in the Rainforest.” And in it, there were a couple different vocabulary words, like gills, lungs, and survive. And that gave them background on how different body parts helped certain animals survive…. A common misconception that some students had was that the worms and catepillars didn’t have body parts because they look like they didn’t have body parts. So, I had to talk to them about that, tell them…they still have certain things to survive... After that we did another investigation…. (Philip, interview communication, September 6, 2018).

Philip positioned texts in various ways throughout his teaching within the *TN Unit Starters* as well as within *Inspire Science* lessons. In the excerpt above, he described reading aloud a picture book related to a science topic which often occurred, especially when he followed the *TN Unit Starters* curriculum. However, Philip also situated text within lessons in different fashion than read aloud. For instance, as a shared reading experience, where all students had individual copies of the text and returned to it for rereading and locating textual evidence. Philip also positioned texts within situations for students to conduct research about science content. He discussed his use of text in an interview:

> They actually had to choose an animal and answer the questions, ‘what does your animal need to live? Where does it live? What does it eat?’ To help them answer that, they each chose their own animal, and they came up here and told me and I looked it up online. On National Geographic Kids, I printed out an article on their animal for them. Copied and pasted. They took that information and answered the question. Then, on the next page, they had to draw their animal and label at least three parts on their body that helps it live (Philip, interview communication, September 6, 2018)

In addition to providing reading, talking, and writing activities in relation to science. Philip demonstrated a commitment to hands-on inquiry in his instruction. He discussed an upcoming investigation with animal habitats:

> Today we're going to do a hands-on activity where I'm going to give them, each table is going to get a jar and we're going to make our own little habitat. So, I'm going out there to get some dirt out of the greenhouse, where I've got extra dirt and I'm going to get leaves at the edge of the woods and under the rain gutter things. They're going to make their own habitat for the bugs with dirt, leaves, and rocks and rubberband it. We will put it in the window and let them observe for a week (Philip, interview communication, January 7, 2019).

Finding four. Teachers experienced tension in science and literacy disciplinary integration, particularly in whether to privilege text or hands-on inquiry in their instruction. In this case, there was still a separate identity of the respective disciplines. Despite the move in the state to integrate, and the newly adopted curricula, teachers still treated the content areas of literacy and science as different instructional time frames or entities within the instructional day.

***Denise*.** Both teachers allotted separate time frames during the instructional day for literacy and science. In Denise's classroom, many times she would use the read-aloud from the *TN Unit Starters* curriculum during her literacy block. However, most times the read-aloud and corresponding questions and writing tasks were completed during her instructional block for science.

> As for example, *The Moon Book* by Gail Gibbons that is a very long book, and that is a very long time for them to sit there. So, by the time they have sat there, and by the time that I

> have finished, I only have a few minutes for them to do the activity and they are pretty much done by then anyway (Denise, interview communication, November 29, 2018).

Denise's literacy block was usually a time for her to integrate other content areas, such as social studies. She also relied on reading from the basal anthology that had been purchased by the state in previous years. Throughout the study, Denise's instruction was mainly focused around literacy work as she followed the *TN Unit Starters* curriculum. However, after she finished the TN Unit Starters, she began to incorporate components of Inspire Science with self-created science labs and texts for reading.

***Philip*.** Philip, in his teaching of science and literacy integration, demonstrated commitment to and understanding of the importance of hands-on science inquiry. Philip's leadership role and interest in science influenced his teaching so that he was able to merge existing curricula that focused heavily on reading and writing with curricula that emphasized hands-on inquiry.

> If I do have a science topic, the story is on science in the basal, like, there's one about plants growing, then I'll pull in both and then I would just continue it into the science block, and I'll just plan books and let them do hands-on activities with that (Philip, interview communication, August 30, 2018).

Additionally, his dedicated afternoon time block for hands-on science inquiry demonstrated his belief that hands-on inquiry is a crucial part of true science and literacy integration. He experienced tension between science and literacy in that he lacked texts for small group reading or copies of texts for all the students. Therefore, he created his own texts from online sources and utilized the previously adopted basal for the morning literacy block and kept the time frames separate for literacy and science, even though literacy was continually interwoven with the hands-on inquiry during the afternoon science block.

Finding five. Teachers learned through implementation of new curricula in ways that enhanced their teaching practice and they submitted substantive ways to improve disciplinary integration. Throughout the study, both teachers expressed ideas about how they felt they would plan differently for the integration of science and literacy in the future. They were also observed taking more immediate action within lessons and units to self-create components for curricular materials and/or activities.

***Denise*.** Throughout the study, Denise weighed the pros and cons of the TN Unit Starters and addressed the gaps with instructional techniques as well as self-created components to curricula materials. Near the end of the study, Denise wrote in an email:

> Again, this unit is great for covering the science standards and incorporating the reading and writing components but does not include the grammar or phonics components. I feel it is wonderful to use in addition to a reading series to try topics and cross the curriculum, but cannot be used alone in a literacy block (Denise, personal email communication, January 7, 2019).

Throughout the duration of the study, teacher participants communicated the aspects of integration that were difficult and they both described changes they would make in future integration efforts. Upon coding the data and looking for overlapping information, I realized that the areas of writing, lack of resources such as texts for students, and expectations for reading aloud texts were the major aspects that teachers identified as areas of weakness that could be improved in future work.

Both teacher participants described writing as an area that needs to be improved upon in future teaching of science and literacy integrative curricula. Denise shared a letter of feedback that she wrote to the local ELA Consultant regarding the *TN Unit Starters*:

> Pros-the topics are interesting to first graders. They cover the standards well and are well organized. Cons- reading the same book multiple times. Some are read consecutively and others are read several days apart. The days apart are worse than two in a row. The students did not like revisiting a book later. They would say, ‘oh no, not that book again.’ For example, we read the book, On Earth, four times in this unit and the days were spread out (Denise, document analysis communication, November 29, 2018).

***Philip*.** Philip also expressed opinions about the *TN Unit Starters* in an interview with me that related to his interpretations about lack of funding:

> I think they’re [TDOE] going to decide whether they want to stick with the basal or spend money on actual texts. I think they’re trying to go toward the [*TN] Units* more. I mean, I like both. The basal makes it easier, just because kids have their own copy. But, with the units, it would take way too much money to be able to buy a book for every kid. So, really it’s just about doing read alouds. Which is good in a way, and it helps kids get ready. Helps them answer questions to you. But, they don’t have something they can read in front of them…that’s a downside to it (Philip, interview communication, September 13, 2018).

Additionally both teacher participants indicated that writing needed to be improved upon in future science and literacy integrative curricula. Denise wrote in a letter of feedback to the state:

> The independent tasks require students to switch between the different modes of writing. The students have not even learned all the different ones until closer to the end of the year. You cannot get proficiency in any of them because you can’t focus on one until they are comfortable with it. For example, you are asking them to write an informational piece one day and a narrative the next (Denise, document analysis communication, November 29, 2018).

Both teachers were able to think and respond to the curricula in critical fashion spurred by knowledge of their students and through realizing gaps in the curricula in addressing their students' academic needs and abilities. By following and thinking critically about the curricula, both teacher participants became more knowledgeable about the synergy of integration.

Theme Two: Place-based Culture Influences Teacher Interpretation and Enactment of Science and Literacy Integration

In this study, both teacher participants identified as cultural insiders to a specific community within rural, middle Appalachia. The teachers used place-based knowledge from their own experiences and knowledge of their students' funds of knowledge to broker understanding and interest in science and literacy with students. Therefore, placed-based culture was embedded in the curriculum and the emphasis on place based understanding helped provide access for students to knowledge of science concepts. Place-based culture was also evident in the discourse of teaching science and literacy integrative lessons. This is not a surprising occurrence in the data given the literature that has been written about culture and connections to placed-based teaching practices (Kingsolver, 2017). Connected to this work, cultural markers in ethnographic research become important because of signification to culture by way of an item, a place, or even a symbol. Many cultural markers were evident in this research. Data analysis from interviews, observations, and documents identified patterns for describing a culture of identity for teacher participants and their interpretations of cultural identity of their students. Therefore, thematic description associated with the second research question was that place-based culture is embedded in science and literacy integrative curriculum and benefits students.

During my coding cycle analysis of the category of culture, I identified teacher actions captured in observational notes, as well as excerpts of dialogue taken during interviews about the classroom culture that were all related to what I interpret as representing a specific cultural community in rural, middle Appalachia. So, as I analyzed data, I noted that both teachers identified as Appalachian. Appalachian culture impacted both teacher participants in terms of how they viewed themselves as cultural insiders. Both participants identified as being natives of Appalachia and having an identity that is contingent upon the Appalachian geography, customs, and family. During the first interview, both teacher participants recalled growing up in the area. Denise spoke about her family and science:

> My father graduated from Southeast University and bought Mountain Motors. It's now Morals. It's been bought. The only plant really in this area. There's one about a mile or so down the road. The same plant. He worked there in high school as co-op and never left. He went up to vice president of the company….he was very engineering minded and had a patent on it. (Denise, interview communication, August 13, 2018).

Both teacher participants grew up in the community and were knowledgeable about their students in terms of Appalachian identity. At one point Denise spoke openly about knowing her student population, based on geographic location:

> You know I can't tell exactly where they live but I have some idea in that I know where they are up in there. So I think I'm probably and maybe Philip too, because we are a little unique because we get all that (Denise, interview communication, August 13, 2018).

Because they knew their students as members of the local community, both teachers exhibited knowledge of how science tapped into students' funds of knowledge in Appalachia, for instance Philip discussed student experiences in science in an interview:

> When kids around here think of science, I mean I hope that most of them…most of the kids up in nearby town especially they come down her especially the boys, they either grow up

hunting with their dad or fishing or doing something out in the woods. So, when they think of that, I think that's what they associate with science. That part of the day is like the animal stuff like that (Philip, interview communication, August 13, 2018).

Finding six. Teachers associated place-based culture with science and conveyed such through storytelling narratives about themselves as cultural insiders to rural, middle Appalachia. I presented data excerpts that illustrate evidence of a common discourse pattern from within the speech community of rural, middle Appalachia known as storytelling narratives. In the literature, storytelling narratives is a cultural marker for how a certain community of Appalachian people communicate. "Storytelling is as old as the mountains," (Martin, 2018, n.p.). Appalachia is traditionally a place, where prior to social media and the rise of the Internet, the people communicated through storytelling. Moore (2011) wrote of Gary Carden, a renowned storyteller in the Balsam Mountains of Western North Carolina that people like Gary, "the Scot-Irish people of Appalachia, don't communicate in dialogue. They communicate in stories" (n.p.). The literature about Appalachian culture also indicates that generations grew up learning the art of storytelling by "creating their own narratives," to describe the events in their lives (Martin, 2018). Both teachers were observed utilizing storytelling in different fashion within classroom instruction and during interview sessions.

***Denise*.** Denise was observed on numerous occasions making references to the farm or mentioning traditional sayings about the weather as she read aloud texts about the weather and seasons from the kindergarten *TN Unit Starter* (Jennings, expanded field notes, August 2018).

A sense of identity in culture and place comes through in teaching. At times this takes the form of storytelling characteristic of Appalachia, as in the note excerpted below from correspondence from Denise:

> And I told them a story…my granny had a dipper at the sink when I was growing up. It always hung there and everybody that came through just drank out of that. It's just gross now, but they thought that was just fascinating that she had a dipper (Denise, interview communication, November 29, 2018)

It was evident in the data that placed-based culture highly influenced curriculum and teaching within the two classroom communities of science and literacy integrative practice. My reliance upon a sociocognitive interactive model of sociocultural learning theory helped me to identify the experiences of both the teacher and students as primary factors in understanding the teaching event. Therefore, identifying how the teachers viewed themselves and their students as insiders to the cultural community in relation to the science topics helped make sense of patterns realized in the data for how teachers told stories as a part of their teaching and for how students commented on knowledge of place-based culture in their connections to the science topic. By emphasizing the place-based culture, teachers could integrate science and literacy in ways that boost student interest and motivation to learn.

***Philip*.** Like Denise, Philip also referenced family in interview dialogue:

> So when I was a kid I spent most of my time either in the woods or down the creek. We always grew a garden. My papaw, he would grow potatoes and so. And he also grew tobacco and sold it (Philip, interview communication, August 13, 2018).

Philip was also observed utilizing storytelling in his instructional discourse with students when engaged in science and literacy integration. For example, he recounted his experiences catching fish in a lesson about animal adaptations (Jennings, expanded field notes, August 2018) and experiences watching his small dachshund move and jump (Jennings, expanded field notes, September 13, 2018) in a lesson about animal vertebrae.

Finding seven. Teachers as cultural insiders, shared cultural understandings with students and drew upon this knowledge to integrate science and literacy. Often during semi-structured interviews and informal conversations, both teacher participants expressed thoughts about how science taps into student interests and background experience, but they also acknowledged that many times technology takes the place of science experienced outdoors. During an interview in August 2018, Denise discussed this with me:

> A lot of them have video games. And to me that seems to be the baby sitter now. And this is off topic, but I'm going to throw this in there. I am not a big video game fan because I feel like it's a downfall. These kids can't communicate. They can't focus. It goes back to that because if they aren't paying attention to me because they are used to that video game fast-paced interface just constantly (Denise, personal communication, August 13, 2018)

There were many occasions that I had the opportunity to discuss both teacher participants' student population. I also had many opportunities to discuss larger ideas about how science literacy could benefit students in middle Appalachia specifically. Both teachers agreed that there is a crisis in middle Appalachia given the amount of poverty in the area. Both teachers realize that many students are raised by their grandparents and may not have academic support at home. In other cases, students' families may work multiple jobs to make ends meet, and therefore experience struggle with homework or other academic supports at home. In an interview, Denise commented about attendance patterns for students and families over the years:

> We have the group that stays and we always have these wanderers that come and go, but usually it's within the same year almost even. Usually if they start kindergarten and they are from this area, they go all the way through. But, we just, you know, you always have those especially at the end of the year….from a month to two weeks before school is out. You will

> get a slew of new students. It's crazy. My philosophy is that they are running from something. We get them a lot of times because they were going to be retained (Denise, interview communication, August 30, 2018).

Despite these challenges, both teachers demonstrated their belief that science content sometimes tapped into student interest in ways that helped the child become more adept in literacy.

***Denise*.** Denise was observed on numerous occasions making a connection with science concepts by asking students about familiar cultural markers in Appalachia, such as farming or noticing the details of the weather by observing nature in a woodland forest:

> The teacher is holding a book to read to the class entitled, *The Year at Maple Hill*. She is pointing to pictures of various farm animals during each season. Students become excited and shouting out about the baby animals in the spring. A student notices and says something about how horses swish their tail to keep the bugs away. Another student said, 'in kindergarten we took a pumpkin seed and it grew into a flower and every day we checked that seed and flower.' There is a discussion of a conveyor belt for baling hay and several of the students say they know about that. There is a discussion about a corn crib and hunting. Several students reference family members. The teacher asks, 'how many students burn wood?' and several student raise their hands. One student says she is making a fire burning stove at her house and another student mentions that everyone else goes to bed early in the winter because it is too dark (Jennings expanded field notes, September 6, 2018).

In another observation during Denise's instruction on October 11, 2018 students discussed the sun:

> Teacher is pointing out a diagram [see the photo where the teacher is pointing to the different diagrams of day and night here] discussing when it is night time. A students says, 'which way is east and west? I know that east is this way' and he points out the window. The teacher points in a different direction and says, 'How do I know that? What does the sun do in the east? It comes up in the east. If you will watch, the sun. The sun goes down for me over that mountain, right over there' and she points. They are all gathered around the book and are all talking about east and west, where the sun rises and sets (Jennings, expanded field notes, October 11, 2018).

Denise tapped into her students' knowledge of rural culture in merging her knowledge as cultural insider with the content of the text alongside the sequence of questions prompted in the *TN Unit Starters*. She discussed an example of this in an interview:

> Around here, I think they are outside more, and they are outside more at night then you would be in a big city, or something, and they've said, 'oh I haven't seen that star before, and we've seen the Big Dipper.' And, I think up in here we still keep those, you know, we still call it the Big Dipper. I don't know if everybody actually goes out and looks, but I can remember when I was a little girl, we looked for the Dipper. So they do that and where the sun comes up and goes down, they noticed that. They were like, 'yeah, our sun comes up over here,' so they didn't know to say that 'this is East' and 'this is West' but I almost feel like they almost have more of a sense of direction being out in the country, then if you weren't. (Denise, interview communication, November 29, 2018).

Denise believed that place-based culture helped motivate her students and helped to reinforce meaning of certain science concepts.

Philip. Philip’s teaching brought several features of science and literacy integration to light. First and foremost, Philip’s lifetime interest in a place-based science of agriculture impacted his teaching beyond curriculum incorporated in classroom instruction. His work with students in the greenhouse illustrated ongoing, authentic uses of science.

For instance, Philip described his work in science with a former student:

> I had a young boy for instance in the past two years. He was a lower child. But he would not want to read the first year I had him at all. But, his dad was a big bear hunter around here, so he spent a lot of time, he would miss class, we would miss days just to go bear hunting with his dad. So I tried as much as I could that first year to get him to read. The second year I started pulling as many nonfiction books and fiction books as I could that had to do with wildlife (Philip, interview communication, August 13, 2018).

This excerpt demonstrates Philip’s interpretations of students in Appalachia and how science connects with culture in a way that could impact student engagement with science and literacy. During an observation in Philip’s classroom in February, 2019, the students were building habitats for their pet worms and I noted one instance where students demonstrated a connection to science through their experience in the physical geography of rural Appalachia:

> The teacher is talking to students about worms and what they need for survival. In a brief conversation about food, a student says that worms eat dead leaves. The teacher says, ‘they eat things that have been broken down like in a forest’ and multiple students excitedly chimed in with connections of what they’ve observed in the woods, things like dead stumps and leaves fall from trees and are all over the place (Jennings, expanded field notes, Februrary 7, 2019).

A knowledge of students' funds of knowledge from growing up in rural, middle Appalachia was evident from the observational field notes and expanded field notes data. Philip was observed in class projecting a photo of his miniature dachshund to teach a lesson about vertebrae in living creatures. This work immediately tapped into students' funds of knowledge as they discussed the various animals they owned as pets and they were observed eagerly working back and forth from an article detailing spinal features, constructing a diagram of vertebrae, and building a model of their own animal of choice out of air-dry clay (Jennings, expanded field notes, September 13, 2018). He expressed the importance of tapping into students' interest in an interview:

> I think if you can get kids interested in something they've already had contact with like outdoors or maybe like me, as their family grows a garden. They already have a connection with that. You can pull in literacy and bring them books and that might make a connection with them (Philip, interview communication, August 13, 2018).

Chapter Summary

In this chapter I presented two main themes that my analysis identified: 1) state-guided curricula and teachers' enactment of science and literacy integration intersect but do not align completely; and 2) Place-based culture influences teacher interpretation and enactment of science and literacy integration. Within each theme, I addressed the seven main findings: 1) Both teacher participants followed the state-guided curriculum and believed the movement to incorporate more science on the part of the state was a move in the right direction to benefit students.; 2) As a result of following the curriculum, teacher participants realized gaps and supplemented the curriculum in ways to meet the students' developmental needs.; 3) As a result of following the curriculum, teacher participants realized gaps and supplemented/adapted the curriculum in ways that demonstrated teacher knowledge and beliefs about the interactions of the individual disciplines of science and literacy within their teaching.; 4) Teachers experienced tension in science and literacy disciplinary integration, particularly in whether to privilege text or hands-on inquiry in their instruction.; 5) Teachers learned through implementation of new curricula in ways that enhanced their teaching practice and they submitted substantive ways to improve disciplinary integration.; 6) Teachers associated place-based culture with science and conveyed such through storytelling narratives about themselves as cultural insiders to rural, middle Appalachia.; and 7) Teachers as cultural insiders, shared cultural understandings with students and drew upon this knowledge to integrate science and literacy. By providing excerpts taken from interviews, other communication with participants, expanded field notes of classroom observations, photos, and other artifacts I documented my construction of an ethnographic case study of two primary grade teachers in an Appalachian setting who are enacting state and district integrated curricula for the first time.

Chapter 5. Discussion and Implications

"The children love all the seasons. They go down by the creek or into the woods or up the dirt roads with their good dogs and they feel more important than anything else in these Appalachian mountains, and probably they think often of God since they know the clouds and trees better than anyone. They have seen what God can do." (Rylant & Moser, 1991, p.13).

Chapter Introduction

In Rylant and Moser's (1991) excerpt above, we are left with an image of young children from rural Appalachia as boys and girls running free and in nature. In contrast, research suggests that the majority of school aged children in Appalachian families are engaged with video games, television, social media, and other technology (Larson, Szczytko, Bowers, Stephens, Stevenson, Floyd, 2018). Both teacher participants in this study reiterated what the literature suggested, that their students are more preoccupied with video games than being outside. Patterns from the data such as this were explicated in chapter four.

Through ethnographic case study case design and ethnographic research methods, I presented the dimensions of one case of science and literacy integrative teaching in rural, middle Appalachia. While my focus and intent was on understanding the workings within one specific context, I still had the larger issues regarding science and Appalachia in the back of my mind. For me as the researcher, I am aware of the issues in Appalachia and the popularization of STEM and while I hope that this case might somehow contribute to collections of case studies in future years that could lead to intrinsically fostering generalizations about the state of science in Appalachia, I made it clear in this report that it was not my intent to generalize in this research.

For all my devotion to both science and Appalachia, I was completely focused on what I can learn from this particular case. This thinking aligns with what Stake (1998) referred to about a case as having "compelling uniqueness" (p.143) in one exemplar bringing a certain light to larger existing issues. He wrote, "[t]his broader purview is applied to the single case, but does not replace it as focus" (p.142).

In the following sections, I presented an overview of the study results, then connections to the literature and the theoretical framework. From there, I reported limitations of the study, implications for the future, and discussion.

Summary of Study Results

In this study, I examined the experiences of two primary grades teachers as they integrated science and literacy in their classroom instruction. Through interview, classroom observation, and document analysis I identified patterns, and ultimately, thematic understandings of how each teacher enacted a synergistic curriculum model developed by policymakers for the integration of science and literacy and which elements of the synergistic model teachers took up in the development and enactment of original units without the guidance of policy. Findings suggested that policy strongly impacted the two teachers' instruction in terms of literacy and science. Hands-on science investigation was described through the textbook adoption, *Inspire Science*. Additionally, the teacher participants demonstrated the capability to create their own science literacy integrative components for hands-on science and the literacy components of reading and writing. Intersections with Appalachian culture were demonstrated throughout the teaching of science and literacy in ways that honor the unique dialogue and ecology of the geographical area. Teachers reflected Appalachian culture in ways that they felt would positively impact their students, particularly by conveying science content in a storytelling manner.

Overview of results in response to the research questions. In this study, I observed and interviewed two primary grade teachers over a seven month period as they integrated science and literacy in their classroom instruction. This study was ongoing at the same time that the state of Tennessee emphasized science standards and literacy development in the primary grades to support improved performance on state assessment in reading.

In chapter one I presented two main research questions:

1. How do two primary grade teachers interpret and enact science literacy integration?
2. In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Teachers in the study interpreted science and literacy integration in ways that reflected their experiences with state standards and textbook curricula and the developmental levels of their students. My findings in the study were:

- Both teacher participants followed the state-guided curriculum and believed the movement to incorporate more science on the part of the state was a move in the right direction to benefit students.
- As a result of following the curriculum, teacher participants realized gaps and supplemented the curriculum in ways to meet the students' developmental needs.
- As a result of following the curriculum, teacher participants realized gaps and supplemented/adapted the curriculum in ways that demonstrated teacher knowledge and beliefs about the interactions of the individual disciplines of science and literacy within their teaching.

- Teachers experienced tension in science and literacy disciplinary integration, particularly in whether to privilege text or hands-on inquiry in their instruction.
- Teachers learned through implementation of new curricula in ways that enhanced their teaching practice and they submitted substantive ways to improve disciplinary integration.
- Teachers associated place-based culture with science and conveyed such through storytelling narratives about themselves as cultural insiders to rural, middle Appalachia.
- Teachers as cultural insiders, shared cultural understandings with students and drew upon this knowledge to integrate science and literacy.

Both teachers' enacted curriculum more closely reflected the synergy of hands-on science investigations plus content reading, writing, talking, and listening, and the use of media to enhance student engagement. They both incorporated elements from the state curriculum and the adopted textbook for science and literacy integration; however, both teachers also created their own curricular materials to supplement existing materials and better meet their students' needs. I identified what they reported as going well and what they struggled with in chapter four. In terms of the second finding, both teacher participants were observed utilizing place-based cultural knowledge in relation to teaching science and literacy integration. Findings from this study suggest there is promise in accessing placed-based cultural knowledge with students in relation to science.

Conclusions

I examined science literacy integration by studying two primary grade teachers in a small rural school in Appalachia. The findings in this study may help researchers and administrators understand how content integration is actualized in classrooms and suggest ways such integration might maximize learning opportunities for teachers and students. I believe, based on my analysis, that this case of science and literacy integration could potentially add to future research studies within rural, Appalachian contexts that are aimed at policy and curriculum development that aims to promote STEM education by way of place-based cultural connections.

Integration of results with relevant literature. In this section I highlight the points of agreement between the wider literature on science and literacy integration and my own findings from this study. I focus on the following commonalities: the varying interpretation of the synergy between disciplines when integrating, the role of top down policy in relation to teacher beliefs and context, the influence of culture and place on science and literacy teaching.

Literature review connections. In this section I highlight the points of agreement between previous research studies and my own. I focus on the following commonalities: the varying interpretation of the synergy between disciplines when integrating, the role of top-down policy in relation to teacher beliefs and context, the influence of culture and place on science and literacy teaching.

The varying interpretation of the synergy between disciplines when integrating. In many of the previous research studies on science and literacy integration there are models that guide the work. In the second chapter of this report, I presented several existing exemplars in the literature of science and literacy integration. Romance and Vitale (1992) found significant improvement in both science and reading scores of fourth graders when the regular basal reading program was replaced with reading in science that correlated with the science curriculum. There is overlap with Romance and Vitale (1992) work within this study. The state of TN is facing the prospect of adopting a reading basal or continuing the support of using individual trade books for instruction such as used for interactive teacher read alouds in the *TN Unit Starters*. The texts used in this study were complex and pertinent to conveying science content, but many times the teacher participants expressed frustration about the level and content being too complex or not having the funds to purchase the texts promoted in the *TN Unit Starters*.

Additional connections to the literature go beyond the type of text used in a science and literacy lesson and include other elements of science and literacy integration: 1) discourse (written and oral); and 2) hands-on science investigation. Guthrie, Anderson, Alao, and Rinehart (1999) reported on a year-long study of a CORI intervention in five third and fifth grade classrooms. CORI was oriented around a science goal and offered direct instruction of reading strategies alongside hands-on experience in order for students to make connections between the experience and the reading. Researchers found that CORI increased students' strategy use, conceptual learning, and text comprehension. Writing, reading, talk, work with technology, and hands-on investigations were key elements within previous studies, such as the example provided of the CORI model. Likewise, other models identified in the research (Kock, 2001; Baker, 1991; Pappas et. al, 2002; Yerrick & Roth, 2005; West et. al, 1997; Chen et. al, 2003; Guthrie et. al, 2000; Palinscar &Magnusson, 1997, 2001; Pearson & Barber, 2014) promoted student interaction with technology, reading high quality texts that convey science content, embedding authentic reading and writing tasks, and incorporating science investigation that is hands-on and that motivates student inquiry. In the current study, all of those components were observed in the participants' teaching. However, the synergistic components in my study had particular structures because they were promulgated by the state and embedded in the procedures and activities of the *TN Unit Starters* and in the district adopted textbook, *Inspire Science*. Reading instruction was deeply impacted by the teachers' use of the *TN Unit Starters* and the books recommended for read aloud. Rarely did teachers hold small group reading instruction within the science content study because of lack of funding to purchase the texts (Jennings, expanded field notes, August-September 2018) or because the unit starter books were too difficult. I did, however, observe that teachers created their own texts, as Philip was observed doing. He modified a *Read Works* text to provide a shared reading with his class on fish bladders (Jennings, expanded field notes, August 2018). Typically, reading became a whole class activity and writing activities took place only intermittently with science journaling in *Inspire Science* and the writing tasks in the *TN Unit Starters*. Video media from *Inspire Science* was the primary technology used in the study but both teachers were also observed choosing videos from other online sources (Jennings, expanded field notes, August 30, 2018).

Talk in the form of storytelling was presented as an indicator of Appalachian culture in chapter four. A lot of talk and storytelling took place in the use of the *TN Unit Starters*, as teachers followed question sequences during the reading to motivate students to discuss science concepts (Jennings, expanded field notes, Aug 2018-Jan2019). The discourse in *Inspire Science* seemed more related to students' writing in the science journal during all steps of an investigation or reading (Jennings, expanded field notes, September 13, 2018). However, both teacher participants engaged their students in conversation about science content and connections to experience (Jennings, expanded field notes, August 2018-January 2019).

The role of top down policy in relation to teacher interpretations. This study highlights the complexities of teaching as impacted by state driven curriculum, the *TN Unit Starters*, and the science textbook adoption, *Inspire Science*. In both teaching contexts, the participants expressed that they appreciated the state's movement toward science and indicated that they were teaching science through reading even before the roll out of the *TN Unit Starters* (Philip and Denise, personal communication, August 30, 2018). As the study progressed, teachers began thinking critically about the curriculum and adapting it in ways that supplemented texts to fill in the gaps. Both teacher participants provided feedback to TDOE with regard to their suggestions for improvement in terms of text choice for teacher read alouds, incorporation of more specific instances per text for addressing work with phonics (Denise, personal communication, September 6, 2018), and improvements in building a progression of writing tasks in an organized way by type of writing identified in TN ELA standards for narrative, opinion, and informational writing. The teachers' decision making and thinking about their teaching of the science and literacy units were considered in my data analysis in terms of how the state policy impacted teaching practice.

The influence of culture and place on science and literacy teaching. Culture was an essential focus in this study. Because of the purposeful identification of participants, I found evidence of Appalachian culture as impacting the teachers' instruction in the classrooms and their viewpoints about students. Frequently, they used storytelling during their read aloud or as they guided a hands-on investigation (Jennings, expanded field notes, August 2018-November 2018). Storytelling was used to also boost vocabulary in some instances (Jennings, expanded field notes, August 2018-January 2019) (Denise, personal communication, September 6, 2018). Additionally, both teachers identified themselves as members of Appalachian culture and made references to community funds of knowledge about hunting, fishing, or gardening, all local customs in middle Appalachia, to contribute to their science instruction (Denise and Philip, personal communication, August-September 2018). It is important for me to note that this research is not intended to elevate Appalachian culture above other cultures. However, the students were representative of the local community in homogeneous fashion and Appalachian cultural references may have made science concepts more accessible to them.

Limitations

Given the scope of this study, the interpretations are unique and may not be representative of the larger educator population. However, it was my intent to describe the two primary grade teachers in great detail. This study was presented as a case study of science and literacy integration in an elementary school in middle Appalachia. Because I used an intact group with definite boundaries instead of choosing from random population sampling, my results are not generalizable. Philip and Denise represent a population of teachers in central Appalachia who teach in rural, majority white contexts. They themselves are white and longtime residents of the immediate area or have family that originates from the area across multiple generations. Because Appalachia is becoming increasingly diverse, this study does not illustrate that cultural diversity. Therefore, this research is a case study of a specific group. Future studies could expand the research to more urban and diverse regions of Appalachia.

Another limitation of this study is that it occurred from August 2018-January 2019, which is a short timeframe for an ethnographic study. The constrictions of finishing dissertation writing alongside the winter weather delays in the school system influenced me to finish data analysis and writing prior to observing the teacher participants' units in the spring. I feel like many connections could potentially be made with the local ecology of Appalachia in the spring units and it is a disadvantage to this report to not have that data included in the analysis. In terms of future ethnographic research about teaching in Appalachia, a longitudinal study would be appropriate.

Delimitations

Teacher interpretations are unique and the selection of participants for this study was purposive because the two teachers were representative of primary grade teaching during the aftermath of the state *Read to be Ready* policy. This study is unique and timely in that it took place in the first year of implementation of the state-guided science literacy unit starters and, because of that, a door was opened to an investigation of how policy and curriculum enactment intersect in an Appalachian setting. Place-based teaching practices may be crucial to ensure that students from rural middle Appalachia have the background and motivation to access future career opportunities related to STEM.

Implications for Future Research

In chapter one I proposed that science literacy integration may be conceptualized as place-based and culturally relevant, encouraging a closer look at such teaching practices in rural educational contexts. For me, this case study of two teachers integrating science and literacy could potentially prompt an investigation of how STEM education considers culture. Is it possible that larger scale studies that focus on rural Appalachian communities could impact state guided curriculum? I am interested in how future research studies might result in outcomes with greater generalizations about how STEM education best fits in rural Appalachia as well as other cultural communities.

Chapter Summary

In this chapter, I discussed the overall findings of my study. I specifically examined science and literacy integration by two primary grade teachers in a small, rural Appalachian school. Interview, observation, and classroom artifacts constituted my data sources, which I analyzed to determine thematic underpinnings in the teachers' interpretation and enactment of science literacy integration. I identified cultural markers of Appalachia in my analyses to support the influence of place and to align with the sociocognitive model I adopted for researching teaching and learning in classrooms. I provided a short summary at the beginning of the chapter, then connected my work to the theoretical framework and literature review that I presented in chapter two. From that point, I presented conclusions of the study in terms of limitations and implications for future research. My hope is that this work leads me into future research into Appalachian studies and educational research connecting agriculture to science and literacy work in Appalachian schools.

Epilogue

In this epilogue I provided information about each teacher participant in terms of their future work in science and literacy integration. Southeast County, like other school districts envision a continued focus on teacher accountability alongside an increasing focus on STEM related teaching practices.

Denise

Denise will finish out her tenth year of teaching at Mountain Primary School in June 2019. She expressed that she plans to finish out her teaching career at Mountain Primary. In the short term, Denise plans to carry out a spring 2019 science unit focused on life science standards for plants.

Philip

Philip plans to end the 2018-2019 school year by leading another life science unit about plants and having his students experience hands on investigations within the greenhouse and gardening. This spring he will complete his fourth year of teaching. In the future, he has suggested that he is interested in obtaining a Master's degree and perhaps licensure for school administration. He does not envision himself teaching second grade for the duration of his career in education.

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Appendices

Appendices

A. Chart displaying ELA standards alignment to science practices

ELA ANCHOR STANDARDS, Alignment to Science Practices	SCIENCE PRACTICES
Key Ideas and Details: CCSS.ELA-LITERACY.CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.	Asking questions (for science) and defining problems (for engineering) to determine what is known, what has yet to be satisfactorily explained, and what problems need to be solved
Integration of Knowledge and Ideas: CCSS.ELA-LITERACY.CCRA.R.7 Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.[1] CCSS.ELA-LITERACY.CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas	Developing and using models to develop explanations for phenomena, to go beyond the observable and make predictions or to test designs
CCSS.ELA-LITERACY.CCRA.R.3 Analyze how and why individuals, events, or ideas develop and interact over the course of a text. CCSS.ELA-LITERACY.CCRA.R.9 Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.	Planning and carrying out controlled investigations to collect data that is used to test existing theories and explanations, revise and develop new theories and explanations, or assess the effectiveness, efficiency, and durability of designs under various conditions
Craft and Structure: CCSS.ELA-LITERACY.CCRA.R.4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone	Analyzing and interpreting data with appropriate data presentation (graph, table, statistics, etc.), identifying sources of error and the degree of certainty. Data analysis is used to derive meaning or evaluate solutions.
CCSS.ELA-LITERACY.CCRA.R.5 Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole. Integration of Knowledge and Ideas: CCSS.ELA-LITERACY.CCRA.R.7 Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.	Using mathematics and computational thinking as tools to represent variables and their relationships in models, simulations, and data analysis in order to make and test predictions.
CCSS.ELA-LITERACY.CCRA.R.6 Assess how point of view or purpose shapes the content and style of a text. Craft and Structure: CCSS.ELA-LITERACY.CCRA.R.4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone	Constructing explanations and designing solutions to explain phenomena or solve problems
CCSS.ELA-LITERACY.CCRA.R.8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.	Engaging in argument from evidence to identify strengths and weaknesses in a line of reasoning, to identify best explanations, to resolve problems, and to identify best solutions.
CCSS.ELA-LITERACY.CCRA.R.8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.	Obtaining, evaluating, and communicating information from scientific texts in order to derive meaning, evaluate validity, and integrate information.

B. Email Invitation to Principals

March 2018

Dear Elementary Principal,

My name is LaShay Jennings and I am a doctoral candidate at the University of Tennessee Knoxville and am looking for teacher participants in grades K-5 to participate in my research study, entitled, *The Integration of Literacy and Science (LS): An Ethnographic Case Study of Appalachian Culture in Elementary Classrooms.*

This study is intended to be a small-scale case study of a classroom context where the teacher is integrating science and literacy instruction. Research that discusses the benefit of science literacy integration is becoming more and more prevalent in this era of school reform. For instance, Tennessee specifically addresses science literacy in the newly adopted 2018 science standards. My goal in this study is to understand the culture of teaching science and literacy in an elementary school classroom as it is experienced by the classroom teacher.

In order to accomplish this work, I will be conducting interviews with the classroom teacher and observations across the one year duration of the study. I will collect documents and artifacts from teaching and learning experiences and I will double check all data analysis with the classroom teacher in order to ensure validity of my findings. All reporting and document analysis will be cross checked with the classroom teacher to ensure validity of findings. Additionally, it is important to note that all school, community, teacher, and student population will be protected by pseudonyms. My work in this study will be non-intrusive and will be conducted with the utmost respect for school and participating teacher schedules.

If you or someone you know is interested in participating in this project, please email me for more information at jjenni30@utk.edu. Thank you!

LaShay Jennings

C. Email Invitation to Teachers

March 2018

Greetings, K-5 Teachers!

My name is LaShay Jennings and I am a doctoral candidate at the University of Tennessee Knoxville and am looking for teacher participants in grades K-5 to participate in my research study, entitled, *The Integration of Literacy and Science (LS): An Ethnographic Case Study of Appalachian Culture in Elementary Classrooms.*

This study is intended to be a small-scale case study of a classroom context where the teacher is integrating science and literacy instruction. Research that discusses the benefit of science literacy integration is becoming more and more prevalent in this era of school reform. For instance, Tennessee specifically addresses science literacy in the newly adopted 2018 science standards. My goal in this study is to understand the culture of teaching science and literacy in an elementary school classroom as it is experienced by the classroom teacher.

In order to accomplish this work, I will be conducting interviews with the classroom teacher and observations across the one year duration of the study. I will collect documents and artifacts from teaching and learning experiences and I will double check all data analysis with the classroom teacher in order to ensure validity of my findings. Additionally, it is important to note that all school, community, teacher, and student population will be protected by pseudonyms. My work in this study will be non-intrusive and will be conducted with the utmost respect for school and participating teacher schedules.

If you or someone you know is interested in participating in this project, please email me for more information at jjenni30@utk.edu. Thank you!

LaShay Jennings

D. Consent Form for Principals

I, ________________________, agree to participate in the research study titled, "The Integration of Literacy and Science (LS): An Ethnographic Case Study of Appalachian Culture in Elementary Classrooms," which is being conducted by LaShay Jennings, M. Ed., Department of Theory and Practice in Teacher Education, concentration in Literacy Studies at the University of Tennessee, under the direction of Dr. Ann McGill-Franzen. This study is a requirement of dissertation research at The University of Tennessee as part of the Doctor of Philosophy Degree Program.

I understand that my participation is entirely voluntary; I have the right to withdraw my consent at any time without giving any reason, and without any penalty or loss of benefits, which I would otherwise be entitled. If I decide to withdraw from the study, the information that can be identified as mine will be kept as part of the study and may continue to be analyzed, unless I make a written request to remove, return, or destroy the information.

My signature at the end of this form indicates my consent to participate in this study and have my interviews audio recorded and transcribed. I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study.

I have been given a copy of this form.

____

LaShay Jennings Signature Date

____________________ ______________ ___________

E. Consent Form for Teachers

I, __________________________, agree to participate in the research study titled, "The Integration of Literacy and Science (LS): An Ethnographic Case Study of Appalachian Culture in Elementary Classrooms," which is being conducted by LaShay Jennings, M. Ed., Department of Theory and Practice in Teacher Education, concentration in Literacy Studies at the University of Tennessee, under the direction of Dr. Ann McGill-Franzen. This study is a requirement of dissertation research at The University of Tennessee as part of the Doctor of Philosophy Degree Program.

I understand that my participation is entirely voluntary; I have the right to withdraw my consent at any time without giving any reason, and without any penalty or loss of benefits, which I would otherwise be entitled. If I decide to withdraw from the study, the information that can be identified as mine will be kept as part of the study and may continue to be analyzed, unless I make a written request to remove, return, or destroy the information.

Purpose of the Study

The purpose of this study is to examine the instructional practices that define science literacy integration in K-6 classrooms by analyzing the practices of elementary level teachers to determine how they perceive effective pedagogy and curriculum in science literacy. In particular, this analysis will focus on where and how teachers use these cross disciplinary practices in the process of teaching and planning for instruction. From such an exploration, perhaps a deeper understanding of effecting science literacy integration will emerge.

Contact Information

The researcher will be available to answer any questions about the research, now or during the course of the research project, via email: jenningslashay@gmail.com or jenningsjl@etsu.edu or via phone: 828-279-5741. Additionally, I may contact the researcher's supervising professor, Dr. Ann McGill-Franzen at amcgillf@utk.edu. Other questions can also be referenced through the University of Tennessee Office of Research and Engagement Compliance Office at 865-974-7697.

My signature at the end of this form indicates my consent to participate in this study and have my interviews audio recorded and transcribed. I understand the procedures described above. My questions have been answered to my satisfaction, and I agree to participate in this study.

I have been given a copy of this form.

____

LaShay Jennings Signature Date

________________ ________________ ________ ________________

F. Consent forms for Parents

Dear Parent of ____:

My name is LaShay Jennings. I am a doctoral student at University Tennessee, Knoxville. This year, your child's teacher has agreed to participate in a research study about the teaching of literacy and science. As part of this work, I will be observing on several occasions during classroom instruction, taking notes and photographs of teacher and student work that will be used as data about Science and/or English Language Arts lessons. Any work samples or photographs of student work will serve as illustrations of what the teacher did during the lesson. We will not evaluate your child's work in any way.

You may choose not to have your child's work photographed. If you DO NOT want your child's work samples included in the study, your child will still participate in the lesson and do the assignment, but his or her work will not be included in the data set. Your child's identity or photo will not be included in any of the work samples. If you choose not to have your child's work photographed this will not impact your child's grades.

Please indicate your preference below and return the form by 3/31/2018 You only need to send this form back if you DO NOT want me to photograph your child's work. You may withdraw permission at any time with no penalty or loss of benefits.

You are receiving two (2) copies of this form. You should keep one (1) copy for your records and return the other copy only if you DO NOT want your child's work to be photographed or photocopied. The researcher will be available to answer any questions about the research, now or during the course of the research project, via email: jjenni30@vols.utk.edu or jenningsjl@etsu.edu or via phone: 828-279-5741. Additionally, I may contact the researcher's supervising professor, Dr. Ann McGill-Franzen at amcgillf@utk.edu. Other questions can also be referenced through the University of Tennessee Office of Research and Engagement Compliance Office at 865-974-7697.

Thank you,

LaShay Jennings

__________________ I DO NOT want my child's work photographed or photocopied.

_____________________________   _________________

Parent/Guardian Signature   Date

G. Assent Forms for Children

LaShay Jennings, Principal Investigator
The Integration of Literacy and Science (LS): An Ethnographic Case Study of Appalachian Culture in Elementary Classrooms

Dear ___________________________________,
My name is LaShay Jennings and I am a doctoral student at The University of Tennessee, Knoxville. I am doing a research study in your classroom to learn how your teacher teaches science and literacy. A research study is a way to learn more about something. I would like you to allow me to observe your class and your teacher during Science and/or English class. I also want to photograph examples or take photocopies of your work. I will use the information I learn from my notes and photographs to teach other teachers about how to teach Science and English. When I teach other teachers about Science and/or English I may show photos of your work. However, we won't tell anyone who looks at the photos your name so your identity will be kept secret. It is OK if you do not want me to photograph or make photocopies your work. If you say yes and you change your mind later, you can ask to not to have photographs or photocopies taken of your work at any time. Your parents know that I am asking you to allow me to photograph or photocopy your work. Before you say yes or no, I want to answer any questions you have about the photographs or the classroom observations. If you think of questions later, just let your teacher know and she can either contact me or can give you my e-mail or phone number so that you or your parent may contact one of us. We will answer any question you have. If you decide to say yes, please write your name and date below and give this form to your teacher. She will make a copy of this form and give you the copy.

H. Interview protocol for teacher participants

Interview Questions to Establish Rapport and Comfort

Describe yourself in terms of where you grew up, your family, your culture, and your community.

Describe yourself in terms of your educational experiences.
Describe yourself in terms of your teaching experiences.

Interview Questions Related to Theoretical Framework

Have you ever attended any professional development in science and literacy integration? If yes, describe it.

How do you think professional development in literacy and science integration could or does influence instruction throughout the school year?
Describe yourself in terms of where you grew up, your family, your culture, and your community.
Describe yourself in terms of your educational/teaching experiences.

Interview Questions Related to Research Question 1: How do two primary grade teachers interpret and enact science literacy integration?

Why are you integrating science and literacy?

What are your beliefs about science and literacy integration?
In what ways do you integrate literacy and science in your current teaching practice?

What texts have you used in a science literacy unit?
How did you use the text?

What do you think students got from the text?
Are there other ways you could have used the text? If so, describe your thoughts.
What hands on experiments have you used in science and literacy units? How did the experiment fit into the unit? What do you think students got from the experience? Are there other ways it could be used? If so, describe your thoughts.

What texts have you used in a science literacy unit?
How did you use the text?
What do you think students got from the text?
Are there other ways you could have used the text? If so, describe your thoughts.
What hands on experiments have you used in science and literacy units? How did the experiment fit into the unit? What do you think students got from the experience? Are there other ways it could be used? If so, describe your thoughts.
What writing experiences have you used in science literacy integration? How did the writing fit into the unit? What do you think the students got from the experience? Are there other ways you think it could fit into the unit? If so, describe your thoughts.
What experiences with words have you offered in a science literacy integration? How did the students engage with the words? Any other ways words could have been integrated? If you have thoughts, please describe.
How do you make decisions about where and how to integrate? Can you describe how you planned for science and literacy integration?
How does literacy intersect with science in a unit? Can you describe how it has happened in your classroom?
Can you describe in detail a science and literacy integrative unit that you have taught?
How difficult is it to integrate science and literacy? How do you manage the difficulties?
What is rewarding about science literacy integration?

Interview Questions Related to Research Question 2: In what ways does Appalachian culture influence teachers' interpretation or enactment of science literacy integration?

Do your students ever demonstrate background experiences about science? If so, could you describe how they showed you?
For use when discussing a student artifact: What do you think about this student work sample? What do you think is important for us to notice about it? How do you think it demonstrates information about the student's work within the lesson? What information does it tell you about the student learning of science? Of literacy?
Can you describe your lesson before I came to observe and before the students broke into literacy centers?
How did you decide to do it that way?

Do you plan differently for your general literacy block than you do for science and literacy integration? Why or why not?
How do you plan for literacy? Why did you choose the text?
Are the literacy and science blocks ever connected around the same content, topic?
How do you come up with your learning goals? How long do you keep them?
Can you describe what you did at the beginning of the unit and how the unit will progress after today?
Which part of the day do you enjoy more? Literacy at 9:30 or science at 1:30? Which is more fun to plan?
Why do you feel that way?
Tell me a little about the lesson you carried out today. Did it go as expected? Were there any unexpected moments? Elaborate. How did you plan for this lesson? What do you like about the lesson? Do you think anything was missing from the lesson that you would do differently in the future if reteaching it? How did you begin the unit?
How did the season unit end? Describe what happened

I. Observation Guide (Field Notes Template)

Date Location	Start Time End Time
Area of Observation (describe or draw the physical environment)	
Discourse or Talk	
Teaching Activities	
Student Activities	
General mood or other areas of observation	
Reflexive Comments	

J. Expanded Observational Field Notes Form, One Example

Date: 1/17/19	**Start Time:** 12:00
Location: Denise's Classroom	**End Time:** 1:00

Area of Observation (describe or draw the physical environment):
The lesson begins with the teacher (T) sitting on the ottoman and reading a book. The students (S) are gathered on the carpet. Then, the T moves to a table at the back of the room, next to a closet where she has stored cups of materials (soil, sand, rocks) under a heating lamp all day. S are given clipboards with a lab sheet and they disperse between four stations that are set up in various places, one station exploring light prisms are set up with black construction paper, magnifying glasses, and black construction paper on the final four desks in the large 4x4 array arrangement of all desks. The other station is located at a kidney table to the side and has mirrors and flashlights for students to use. There is a book on the shelf at the front of the room, Let's Explore Light

Discourse or Talk:
T: What changes when the sun is far away or close to the earth? What changes? A S is wiggling around on his bottom on the carpet and he responds, S: "the temperature. The teacher repeats his comment, "yes, the temperature."
There is a brief conversation about the connection to the seasons.
T: "When it is summer, is the sun really close or really far away…."
T: "In the winter, if you remember it is colder because it is really far away if you tilt it…"
T: "In the summer, if you are outside and it is really hot what can happen?"
T: "If you are near a fire outside. Tell me about fire, the closer you get to the fire, how does it feel?"
S: "It would be warm, but it would be like a good warm—what a student said in response to the T talking to the class about how the sun affects the earth in different ways for black pavement versus standing on grass
T: "Today we are going to test and see, which gets the hottest? Sand, dirt, rocks. We have been talking about light. On the first day we talked about where it came from. The sky, what about the sky?
T: "How does a flashlight or torch give off light?"
S: "ceiling"
T: asks, "like a ceiling fan with lights? What is another thing like a flashlight that you could carry with you outside?" Teacher helps a student remember the word lantern.
T: "We talked about how it is made?"
T: "So then we talked about how it moves in a straight line?"
T: "What if I shine it on the wall? What if I stand in between the person shining the flashlight and the wall?"
T: "The sun does two things to the earth- gives us light and heat."
"Without the light from the sun, would we exist?"

Teaching Activities:
T and S are at the carpet and discussing natural light, light found in nature. T has Inspire Science Light Energy, Lesson 1: Sunlight and Earth's Surface on the SMART TV. S are gathered at the carpet at her feet. Teacher moves to her desk to move to a video of the sun rising and giving off light. We talked about how the sun affects the temperature of water. Does the sun make water warmer? **I took a photo of the Inspire Science background on the SMART TV and the teacher sitting on the stool in front of her students. Teacher shines the flashlight close to the brown top of the stool and connects it to how the sun shines on the earth. They read the story about the turtle and the sun/light. Teacher clicks through the modules on the Inspire Science online program. She is holding the lab sheet and explaining what students are going to write about. Some students will be playing with a flashlight and a mirror.
Students go to their desks and the teacher distributes the science lab sheet.

Student Activities:
The students rotate through small groups creating a rainbow reflection on the black paper from a prism made from two magnifying glasses.
The other center is students shining a flashlight in a mirror to reflect light. ** check pictures. The final group is the teacher letting students feel the earth materials after having been under the heating lamp. The teacher is now distributing the lab sheets and T is discussing what she was surprised by with the earth materials and light experiment.

General mood or other areas of observation:
Students are telling her that she is the very best teacher and are hugging the teacher. They are very excited about conducting the science experiment.

Reflexive Comments:
As I walked around to take photos of student work, I noticed that students were actively sounding out their words. It is obvious to me that their experience with the temperature and the hands on science motivates them to write the words and complete the thought in writing. They know what they want to say about what happened and they are motivated to get the message in writing.
Check the photos on your cell phone of the teacher holding the lab sheet and explaining it.
Check photos of students conducting the investigation and writing.

K. Observation Record, Denise

Date	Time Frame	Topic or Focus
8/28/2018	12:00-1:00	Teacher conducted a lesson within the kindergarten TN Unit Starter connected to science standards for weather.
8/30/2018	8:00-9:40	Teacher read aloud a book about a storm from the kindergarten TN Unit Starter and facilitated her students into small group literacy work for associated tasks.
9/6/2018	12:00-1:30	Teacher read aloud a book about the seasons; asked questions to stimulate talking about seasons; students completed a writing task.
10/11/2018	12:00-1:30	Teacher read aloud book about day and night; asked questions to stimulate talking about day, night, earth and sun movements; students completed a writing task.
10/25/2018	12:00-1:30	Teacher read aloud a book about Galileo; asked questions to stimulate discourse; students completed a writing task.
11/15/2018	12:00-1:30	Teacher read aloud a book about the moon; asked questions to stimulate discourse; students completed a writing task.
11/29/2018	12:00-1:30	Teacher read aloud a book about animal characteristics; asked questions to stimulate discourse; students completed a series of worksheets related to grammar, phonics, CLOZE all on the topics of animals.
12/18/2018	12:00-1:30	Teacher read aloud a book about animal characteristics and students completed worksheets for grammar, phonics, CLOZE on the topics of animals.
1/7/2019	12:00-1:30	Teacher read aloud a book about Lewis and Clark; asked questions to stimulate discussion; students completed a writing task.
1/17/2019	12:00-1:30	Teacher shows a short video of a sunrise and discusses with students different books they read in previous days about sunlight; teacher reviews the small stations for investigating light; students divide up, conduct each investigation, and writes on the lab sheet. The teacher facilitates writing and experimenting with individual and small groups of children.
2/7/2019	12:00-1:30	The teacher spends some time reminding students of the labs and readings done on previous days; she explained a newly designed lab sheet and students repeat the labs from the previous day on the new format; teacher facilitates writing and experimenting with individual and small groups of children.

L. Observation Record, Philip

Date	Time Frame	Topic or Focus
8/28/2018	1:00-2:30	Teacher presented a question for students; students wrote the question in their science journals; students conduct the science investigation and wrote in student journals; teacher circulated room and facilitated with discourse and verbal probes; teacher distributed copies of text to students; teacher read aloud while students read silently; students highlighted text to find evidence; class discussion of science question and how reading helped them understand the science investigation.
8/30/2018	9:50-11:30	Teacher prompted a discussion about culture; distributes copies of an article to all students; teacher reads aloud article; students mark on the text to locate answers to teacher prompts; students complete a writing task comparing the article to a previous reading; students break into literacy stations to work independently on a literacy skill
9/6/2018	1:00-2:30	Teacher read aloud a book about the rainforest; teacher projected an image of a female scientist cartoon figure with a science question; students sorted photocopied images of animals and glued them into the science journal; students wrote in their science journals; teacher facilitated individual students; whole class discussion about the work related to the science question
9/13/2018	1:30-2:30	Teacher asked students a science question; he projected an image of a cartoon character with the question; students wrote the question in their journal; students were distributed individual texts they chose and read about previously with images of specific animal backbones; students used the image to construct a model backbone; students drew and wrote about their article and model of backbone in their journals; teacher facilitated work
10/18/2018	1:30-2:30	Teacher displayed an image of life cycle diagram and engages students in remembering the books he read aloud earlier about butterfly life cycle; teacher read writing prompt; students wrote; teacher facilitated student progress and collected the writing samples.
10/25/2018	1:30-2:30	Teacher played a digital read aloud of a text; teacher provided students a copy of an article; students round robin read the text; students wrote in science journal; class discussion occurred about the writing and reading
11/29/2018	1:30-2:30	Teacher displayed image of a desert; students wrote in their science journals; teacher displayed a digital read aloud of an ebook; students choral read the text; students wrote in their journals about the read aloud; class discussion occurred about the reading and writing
2/7/2019	1:30-2:30	Teacher led a discussion about several texts he read aloud on previous days; students wrote in journals; teacher dropped a worm into individual cups on students desks; students wrote in journals; teacher prompted discussion and writing; teacher distributed gummy worms; students wrote in their notebooks

M. Interview Record, Denise

Date	Time Frame	Topic or Focus
8/13/2018	9:00-10:00	Teacher described her background and her plan for science literacy teaching.
8/30/2018	9:00-9:40	Teacher reflected on recent lesson on weather.
9/6/2018	12:30-1:00	Teacher described several recent lessons and her thoughts about science literacy teaching.
11/29/2018	12:30-1:00	Teacher described the science literacy teaching completed and described upcoming work. Teacher discussed the two types of curriculum and student performance.
1/7/2019	12:30-1:30	Teacher discussed self-created light unit.

N. Interview Record, Philip

Date	Time Frame	Topic or Focus
8/13/2018	10:00-11:00	Teacher described his background and his plan for science literacy teaching.
8/28/2018	2:00-2:30	Teacher reflected on recent lesson on animal characteristics.
8/30/2018	1:00-1:30	Teacher discussed the difference between literacy block and science block. He also described his upcoming work with the TN Unit Starter for 2nd grade in Life Science.
9/6/2018	1:00-1:30	Teacher described the science literacy teaching completed with animal adaptations and animal classification. He described the texts he read aloud and the texts he created from National Geographic for shared reading. Teacher discussed the two types of curriculum (Inspire Science and TN Unit Starters and student performance.
9/13/2018	12:30-1:30	Teacher described upcoming work with animal habitats. He discussed using the basal for reading within science lessons. Discussed the type of writing students are expected to do.
10/18/2018	1:00-1:30	Teacher described the science literacy teaching completed and described upcoming work with life cycles. Teacher discussed finishing the TN Unit Starter and continued use of Inspire Science.
1/7/2019	1:00-1:30	Teacher described the science literacy teaching completed with habitats and described upcoming work. Teacher discussed the two types of curriculum and the need. Teacher discussed some of students' experiences with science at home.

O. Coding Chart for Observational Field Notes

Observational Data Entry	Descriptive and Category Codes	Axial Codes and Themes Relationship of science and literacy.	Analytic Memo from Expanded Field Notes
Students are chiming in impulsively as she reads the story. There is a lot of discussion about vocabulary. The teacher finishes the read aloud and displays the book with the other books on the book shelf. She is asking them questions about weather. Teacher presses a button at the corner of the SMART TV and there are vocabulary words. She points out key vocabulary- fall winter spring summer	Read aloud	Positioning individual components of each content to be mutually beneficial. Theme: synergy and policy	I think it is interesting how the text is positioned within the science lesson. It was the primary focus. (Jennings, analytic memo, August 2018) I wonder how the teacher would carry out this lesson without the program? (Jennings, expanded field notes, August 2018).
	Books		
	TN Unit Starter format for science and literacy integration: reading, talking, and writing	Theme: synergy and policy	
	Technology Digital texts		

P. Coding Chart for Interview Data

Observational Data Entry	Descriptive and Category Codes	Axial Codes and Themes Relationship of science and literacy.	Analytic Memo from Expanded Field Notes
I think it was the format, and the amount. I think that was five things, was too much to give a 1st grader a task to do. And really, it was more like eight things they had to, on the inside they were supposed to write and draw so they had to put pictures and words for three different topics, put a summary on the back and put a title page with the pictures. So, I just feel like that was a lot for them to do. And I know that you can do this unit any time of the year, but I think choosing to do it when we did is hurting, more or less, the outcome (Denise, personal communication, January 2019)	Student writing sample was difficult.	Teacher interpretation of state-guided curriculum	The teacher is expressing frustration because the students are struggling to meet the expectations of the writing assignment. How could brochure writing happen in writing instruction? Has there been professional development offered by TDOE for writing instruction? (Jennings, personal memo, January 2019)
	Science concept in writing	Teacher interpretations of student development.	
	Writing as evidence of science knowledge	Teacher emotions in relation to state curriculum (macro culture) and student performance (micro culture) are cultural markers.	

Vita

Jody LaShay Jennings is a doctoral candidate from *University of Tennessee Knoxville*. Upon graduation, her degree will be in Doctorate of Philosophy in Literacy Studies (Spring 2019). She has served at East Tennessee State University as a clinical instructor for the Department of Curriculum and Instruction in the Clemmer College of Education for the past five years. Her research areas of interest during the current year include her doctoral research, *The Integration of Literacy and Science (LS): An Ethnographic Case Study set in an Appalachian Elementary School*, through the University of Tennessee Knoxville. Before her doctoral work, she conducted research from fall 2013-spring 2014 on a science and literacy integration project, *Science Literacy: Black Mountain Primary and Elementary Schools*, *East Tennessee State University*. Prior to her work in post-secondary education, LaShay taught first, second, third, and fourth grades and served as a K-6 curriculum/instructional coach in schools in Asheville, North Carolina.