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American Indian K-12 students comprise less than 1% of the student population in the U.S. In southeastern North Carolina, the largest North Carolina tribe of American Indians, Lumbees, live and attend schools where they often perform poorly on standardized tests. The Lumbee Indians generally live in areas that are rural and economically disadvantaged and they speak a dialect of English, which is seldom heard except near their homeland. Away from their homeland, Lumbee speech is often construed as non-Standard English.

The Lumbees have close knit family relationships and where you come from and where you live are important facts to assess. Because Lumbees live in rural areas, they are often involved in outdoor activities such as hunting, fishing, and gardening. They have a strong sense of place, particularly regarding the Lumber River, which runs through their homeland.

Historically, schools, community organizations and universities have not provided sufficient informal science education opportunities for Lumbee youth. The purpose of this study was to document the experiences of nine Lumbee youths at a residential, week-long herpetological education experience for Lumbee students and others. The Funds of Knowledge (FoK) that these students brought to this experience and how these FoK were integrated into the herpetology program's Community of Practice (CoP) were examined.

A mixed methods, ethnographically inspired, single case study was conducted and both qualitative and quantitative data were collected. Data collected included individual interviews, pre/post-tests, pre/post-surveys, observations and field notes.

Analyses of qualitative and quantitative data demonstrated specific FoK of these Lumbee youths and the strategies they employed to be dynamic, contributing members of the informal science education herpetological CoP. As a result of the herpetology experience, significant positive changes in the attitudes of these Lumbee youths toward science and their understanding of related science concepts were apparent.

The findings from this study suggest that these Lumbee youths have FoK from their rural ways of knowing and being that allow them to perform especially well in outdoor, environmental settings. Further, these youths are often reflective learners who do not put themselves forward in formal, classroom situations. Finally, their FoK serve them well as members of learning groups. For all of these reasons, outdoor informal environmental/science educational opportunities may provide favorable venues for Lumbee youth to demonstrate their abilities and interests in science.

CONTRIBUTIONS TO A HERPETOLOGICAL COMMUNITY OF PRACTICE:

FUNDS OF KNOWLEDGE OF LUMBEE YOUTH

by

Mary Callis Ash

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APPROVAL PAGE

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TABLE OF CONTENTS

Page

LIST OF TABLES xi

LIST OF FIGURES xiii

CHAPTER

I. INTRODUCTION 1

Derivation of the Conceptual Framework..2
Operational Definitions and Concepts..3
Indian Appellation 3
The Lumbee Indians of Southeastern North Carolina: An Indigenous People 4
Informal Environmental Education...6
Place-based Education and Informal Environmental Education 7
The Importance of Place to the Lumbee People 8
Communities of Practice (CoP) and Funds of Knowledge (FoK)..10
Herpetological Research Experiences (HREs) as a Joint Enterprise of The Herp Group (THG)...14
Significance of and Rationale for this Study 15
Research Questions..16
Research Design...17
Limitations of the Study..19
Summary and Organization of the Dissertation...20

II. REVIEW OF THE LITERATURE 22

Introduction..22
Communities of Practice (CoP) 22
Operational Definition of Communities of Practice (CoP)............22
Situated Learning and Legitimate Peripheral Participation (LPP) 24
Legitimate Peripheral Participation (LPP) as an Analytical Perspective on Learning 27
Characteristics of Communities of Practice (CoP) 28

The Iterative Relationship between a Community of Practice (CoP) and Legitimate Peripheral Participation (LPP) 31
Communities of Practice (CoP) in Science Education 32
Funds of Knowledge (FoK) 38
Development of Concepts Related to Funds of Knowledge (FoK) 38
Funds of Knowledge (FoK) as Practices 39
Funds of Knowledge (FoK) in Education 40
Lumbee Community and Home Practices that Might Provide Funds of Knowledge (FoK) 52
Place-based Education and Informal Environmental Education with Reference to the Lumbee Sense of Place 55
The Herp Group (THG) as a Community of Practice (CoP) 59
Herpetological Research Experiences as Joint Enterprises 60
Conclusion 70

III. A SHORT SOCIAL, POLITICAL, ECONOMIC, AND EDUCATIONAL HISTORY OF THE LUMBEE TRIBE 72

Indian Appellation 72
The Lumbee People as Americans and Southerners 74
An Introduction to the Lumbee Tribe of Eastern North Carolina 75
Competing Theories of Lumbee Ancestral Origins 79
Colonial Robeson County 80
Early Black Settlers 81
Indian and Black Relationships during Colonial Times 81
The Lumbee People during Colonial Times 81
The American Revolution and the Early 1800s 82
From 1835 to 1885: The Half-century Dark Ages 84
From 1835 to the Start of the Civil War (1864) 84
From the End of the Civil War (1865) until 1885 87
The Lumbee Acquire State Recognition and a School System 92
The Croatian Indian Normal School 93
A History of the Lumbee People after 1885 95
From 1885 through the End of World War I 95

The Great Depression 98
World War II Initiates Great Social Changes 99
The Era of Integration 101
The 1970s and 80s 105
The 1990s 106
Robeson County Enters the 21st Century 107
The Future 112

IV. METHODOLOGY 113

Purpose 113
Research Design 114
Program Description 116
Herpetology Education in Rural Place and Spaces (The HERP Project) 116
Sandhills Camp and Resort (SCR) Herpetological Research Experience (HRE) 119
Selection of SCR HRE Participants 120
Demographics of all SCR Participants 122
Lumbee SCR Participants 124
Daily Schedule for SCR HRE, 2012 138
Conceptual Framework 141
Experiential Knowledge 142
Existing Theory and Research 142
Pilot and Exploratory Research 143
Thought Experiments 143
Formulation of a Conceptual Framework 144
Research Procedures 144
General 144
Protocols 145
Mixed Methods Data Collection Procedures 146
Data Analysis 147
Potential Ethical Issues 150
Validity 151
Summary 152

V. RESULTS AND DISCUSSION: QUALITATIVE DATA 153

Introduction 153
Development of Codes and Themes 154
Group 1: Aaron and Barry (and Also Jewel) 158

Group 1's Ways of Knowing and Being before the HRE 158
Group 1's Ways of Knowing and Being during the HRE 162
Group 1's Ways of Knowing and Being after the HRE 172
Group 2: Dalton, Larry, and Sherry 176
Group 2's Ways of Knowing and Being before the HRE 176
Group 2's Ways of Knowing and Being during the HRE 178
Group 2's Ways of Knowing and Being after the HRE 201
Group 3: Gavin, Harold, and Tonya 204
Group 3's Ways of Knowing and Being before the HRE 205
Group 3's Ways of Knowing and Being during the HRE 207
Group 3's Ways of Knowing and Being after the HRE 227
Qualitative Conclusions 231
General 231
Qualitative Findings That Can Be Used to Answer Research Questions 231
Research Question 1: What FoK Did these Lumbee Youths Bring to the SCR CoP? 231
Research Questions 2 and 3: How Did these Lumbee Youths Come to Have These FoK and How Did They Leverage Them? 232
Research Question 4: How Did these Lumbee Youths Contribute to the SCR CoP? 240
Research Question 5: How Did the SCR HRE Contribute to these Lumbee Youths' Understanding of and Engagement with Science? 244

VI. RESULTS AND DISCUSSION: QUANTITATIVE DATA 247

Introduction 247
Description of Instruments Used to Collect Quantitative Data 248
Description of Pre- and Post-tests 249
Description of the Pre-survey 249

Description of the Post-survey..250
Comparison of Pre- and Post-survey Structure............................251
Analysis of Quantitative Data..252
Participants' Demographic Information and Understanding of Herpetology and Field Science at the Start of the HRE..252
A Group Profile of Lumbee Participants Extracted from Pre-survey Data..255
Lumbee Participant Increments in Understanding of Herpetology and Field Science during the HRE.....................264
Comparison of Lumbee Participants' Views of Science before and after the HRE..265
Comparison of Lumbee Participants' Involvement in Science before and after the HRE......................................270
Quantitative Conclusions...275
General...275
Quantitative Findings That Can Be Used to Answer My Research Questions...278

VII. META-INFERENCES AND IMPLICATIONS FOR FUTURE RESEARCH 282

Characterizations of Signature FoK and Contributions to the HRE CoP for the Nine Individual Lumbee Participants...283
Aaron...283
Barry 284
Dalton..284
Gavin...285
Harold 286
Jewel 286
Larry..287
Sherry..288
Tonya 289
Meta-inferences...290
Directions for Future Research 294
Limitations of the Study..296
Research Design Limitations 296
Avoidance of Essentialization of Lumbee American Indians..296

REFERENCES 298

APPENDIX A. PRE-TEST/POST-TEST FOR THE SCR HRE, 15-20 JULY, 2012 315

APPENDIX B. PRE-SURVEY FOR THE SCR HRE, 15-20 JULY, 2012..322

APPENDIX C. POST-SURVEY FOR THE SCR HRE, 15-20 JULY, 2012 330

APPENDIX D. DAILY SCHEDULES FOR THE SCR HRE, 15-20 JULY, 2012 335

APPENDIX E. YOUTH INTERVIEW PROTOCOL FOR THE SCR HRE, 15-20 JULY, 2012..341

LIST OF TABLES

Page

Table 1. Evidence that THG functioned as a CoP 65

Table 2. Number and Percent of Students at or above Achievement Level III in Biology at Lumberton Senior High School 110

Table 3. Number and Percent of Students at or above Achievement Level III in Biology at Purnell Swett High School 111

Table 4. Ethnicity and Gender Demographics of All SCR HRE Participants for 2012 (*N* = 27) 121

Table 5. Ethnicity, Gender, and Other Significant Demographics of SCR HRE Participants by Group for 2012 (*N* = 27) 123

Table 6. Demographic Information for the Lumbee Indian Youths 125

Table 7. Demographic Characteristics of the Schools Attended by the Lumbee Indian Youths 126

Table 8. Themes and Subthemes 155

Table 9. Domicile Locations of the Lumbee Participants vs. Non-Lumbee Participants 253

Table 10. ANOVA Comparison of Pretest Criteria and Criterion Groupings, Means and Standard Errors for Those Criteria That Showed Statistically Significant Differences among Groups 254

Table 11. Lumbee Participants' Engagement in Everyday Science and/or Family Activities Explicitly Tied to Science 257

Table 12. Lumbee Participants' Engagement in Everyday and/or Family Activities That Might Prepare Participants for an HRE Experience 259

Table 13. Lumbee Participants' Science Hobbies 263

Table 14. Lumbee Participants' Pre- and Post-test Scores and Increments in Test Score Achieved during the HRE 265

Table 15. Lumbee Participants' Views of Science before the HRE................................267

Table 16. Lumbee Participants' Views of Science after the HRE 268

Table 17. Lumbees' Participation in Science before the HRE..271

Table 18. Indicators of Increased Participation in Science by Lumbee Participants after the HRE 274

LIST OF FIGURES

Page

Figure 1. Locations of Principal Native American Tribes in North Carolina.................. 77

CHAPTER I

INTRODUCTION

> Members of cultural groups develop systematic knowledge of the natural world through participation in informal learning experiences and forms of exploration that are shaped by their cultural-historical backgrounds and the demands of particular environments and settings. Such knowledge and ways of approaching nature reflect a diversity of perspectives that should be recognized in designing science learning experiences. (Bell, Lewenstein, Shouse, & Feder, 2009, p. 296)

I have worked in Lumbee Indian country since 1989, first as a community college instructor and then since 2008 as a science educator at the regional university located in the heart of Lumbee country. The Lumbee Tribe, with more than 55,000 members, is the largest American Indian tribe in North Carolina, and is indigenous to the southeastern coastal plain of that state. Most Lumbees reside in the predominantly rural counties of Robeson, Hoke, Cumberland and Scotland (Blu, 2001; Sider, 2003; Oakley, 2005; North Carolina Commission of Indian Affairs, 2008). Lumbee K-12 students are often positioned as disadvantaged when their school performance is compared to their White classmates' performance on standardized tests in all content areas (Orfield, Losen, Wald, & Swanson, 2004).

I began my doctoral studies in 2008 and early in my doctoral program I became involved in weeklong residential, summer herpetological field experiences (HREs) for high school students. These HREs provided students the opportunity to conduct fieldwork in herpetology, the study of reptiles and amphibians. During their HRE research experiences participants learned field techniques that included capturing, identifying, and marking both terrestrial and aquatic turtles. Participants also learned how to identify and properly handle frogs, salamanders, snakes and lizards. The Herp Group (THG) (described in more detail later in this chapter) designed these informal science experiences for high school students.

I worked as a volunteer at the 2009 HRE, and during that week the THG decided to recruit Lumbee high school students to attend an HRE, as I knew of no other similar programs available to them in their home counties. THG successfully recruited four Lumbee male youths who attended the 2010 HRE. I studied these four youths as an educational researcher in the summer of 2010 and I recounted and reflected on their experiences in a paper published in the *Journal of American Indian Education* (Ash, Carlone, & Matthews, 2015). The experiences of these four Lumbee males were instrumental in helping me formulate the theoretical framework for my dissertation research, and I provide more details about my findings from the 2010 study in Chapter V. But, briefly, I was fascinated with how these Lumbee youths quickly "participate[d] in scientific activities and learning practices with others, using scientific language and tools and practices" (Bell et al., 2009, p. 4). In doing so, they used "every day practices" (González, Moll, & Amanti, 2005a, p. 1) they had acquired as a result of living with family and friends in their rural communities.

Derivation of the Conceptual Framework

During my coursework at UNCG, I had become aware of the theoretical perspectives of communities of practice (CoP), (Lave, 1991; Lave & Wenger, 1991;

Wenger, 1998, 2006), and funds of knowledge (FoK) (Moll, Amanti, Neff, & González, 1992). I speculated that THG was a scientific CoP that developed these residential HREs to initiate high school students into their community's scientific herpetological field practices. Further, I conceived that Lumbee youths brought FoK that originated in their rural backgrounds that afforded their easy integration into, and unique contributions to, this scientific CoP.

For these reasons, I was interested in investigating how the FoK of Lumbee youths contributed to THG's community during an HRE conducted at Sandhills Camp and Retreat (SCR, pseudonym) July 15 to July 20, 2012. Also, I assessed the effects of the THG's community on the Lumbee youths understanding of and engagement with science. A National Science Foundation grant (Grant No, DRL-1114558) supported this endeavor.

Operational Definitions and Concepts

In the next several paragraphs, I define important terms and concepts associated with, or referred to, in my research questions (presented later in this chapter). This section also includes a brief introductory literature review of CoP and FoK in order to provide the rich definitions necessary for understanding the premise of my dissertation.

Indian Appellation

What we call, or who and how we term Indigenous Peoples of the United States is important, especially to Indigenous People. In Chapter III, I present details of my literature review which brought me to the following conclusion: in this dissertation, I preferentially refer to these peoples as *American Indians*, except I may use *American Indian*, *Indian* and *Native American* interchangeably to avoid repetitious text.

The Lumbee Indians of Southeastern North Carolina: An Indigenous People

The name of the Lumbee Tribe is derived from the river that meanders through Lumbee country. Although in 1809, North Carolina legislation designated this river as the Lumber River, it was originally known as the Lumbee River (Locklear, 2010; North Carolina Commission of Indian Affairs, 2008). The more than 55,000 members of the Lumbee Tribe live primarily in Robeson, Hoke, Cumberland and Scotland counties in North Carolina (North Carolina Commission of Indian Affairs, 2008). The Lumbee people constitute the largest American Indian tribe in North Carolina, the largest tribe east of the Mississippi River, and the ninth largest tribe in the United States (Brewer & Reising, 1982; North Carolina Commission of Indian Affairs, 2008; Ross, 1999).

The exact origins of the Lumbee are unknown (Ross, 1999) and controversial (Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003; Woods, 2001). Despite their mysterious origins, the Lumbee have forged a distinct American Indian identity (North Carolina Commission of Indian Affairs, 2008). Written records of interactions of European settlers with the Lumbee ancestors exist as early as the first decades of the eighteenth century (Ross, 1999). European settlers observed Lumbee Ancestors in 1724 on Drowning Creek (now the upper Lumber River) in present day Robeson County (North Carolina Commission of Indian Affairs, 2008). The Lumbees have resided continuously in southeastern North Carolina for at least 280 years (Ross, 1999) and were recognized as Native Americans by the State of North Carolina in 1885 and the Federal

Government in 1956 (Padget, 1997). Numerous scholars speculate that Lumbee Indians descended from different coastal Indian peoples who coalesced in the region of the Lumber River. These American Indian people migrated to this area as their original populations were decimated by wars and diseases precipitated by European immigrants (Bailey, 2008; Blu, 2001; Dial & Eliades, 1996; Knick, 2000; Lumbee Tribe of North Carolina, 2013a; Maynor, 2005; Sider, 2003; Woods, 2001). Managing to survive in an isolated, swampy, and (at that time) undesirable area, the Lumbee developed into a unique American Indian community that is based on kinship bonds (Bailey, 2008; Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003). "Who are your people?" and "Where do you stay?" were among the first questions that Lumbee participants asked of one another at the beginning of the HRE (Blu, 1996; Maynor, 2005).

Woods (2001) reminds us that Europeans (mostly local Scottish immigrants) produced most of the written records about the Lumbee that currently influence scholars of Lumbee history. Therefore, Woods (2001) argues these historical accounts fail to address the history of the Indigenous Peoples who occupied this region before other American Indians sought refuge with them to escape the ravages of war and disease. She argues that the "failure so far to examine the state of the Lumbee prior to the seventeenth century is to ignore their existence, history, and culture as aboriginal peoples of the American continent, with the resultant effect of depriving them of their native birthright" (Woods, 2001, p. 3). Knick (2000) agrees that documentary evidence about the Lumbee's ancestors began to appear in the early 1770s. Additionally, he finds that people in the Lumbee community (both Lumbee scholars and lay persons) tend to believe that Lumbee history began during the 1580s with John White's Lost Colony. Contrary to the belief that all the ancestors of the Lumbee migrated to the areas that surround Robeson County after Europeans came to North America, Knick (2000) presents archeological evidence that this region was occupied throughout Paleo-Indian, Archaic, and Woodland times. He argues that Native Americans occupied this region by 12 to 10,000 BC and continued to live in this region consistently into the 1700s AD (Knick, 2000).

Sanders (1999) defines Indigenous Peoples as

> [A] collectivity which has descent from the earliest surviving population in the part of the State where the people traditionally lived (whether still living in that area or, as a result of involuntary relocation, in another part of the State) and which has a distinct identity associated with its history. (p. 9)

Clearly, the Lumbee's continuous residence in the same region of southeastern North Carolina and their distinct American Indian identity that is associated with that region (North Carolina Commission of Indian Affairs, 2008) establish the Lumbee as an Indigenous People who have resided in southeastern North Carolina for many centuries.

Informal Environmental Education

Falk, Heimlich, and Foutz (2009) define informal education as learning that occurs in non-institutional settings rather than public schools. Falk (2008), discussing informal education in his concluding chapter of a National Science Teachers Association (NSTA) text (Yeager & Falk, 2008), states, "Learning opportunities are not limited to the nine-month school year and six-hour school day; learning occurs on weekdays and weekends, mornings, afternoons, and in the evening. Science learning is life-wide and life-long" (p. 246). Informal environmental education (IEE) combines informal education and environmental education. I chose to employ the United States Environmental Protection Agency's definition of environmental education as set forth by Falk et al. (2009):

> Environmental education increases public awareness and knowledge of environmental issues and challenges. Through environmental education, people gain an understanding of how their individual actions affect the environment, acquire skills that they can use to weigh various sides of issues, and become better equipped to make informed decisions. Environmental education also gives people a deeper understanding of the environment, inspiring them to take personal responsibility for its preservation and restoration. (p. 7)

Place-based Education and Informal Environmental Education

Smith (2013) broadly defines *place-based education* as a focus on locale as a basis for teaching and learning. Such approaches have the ability to merge community and environmental issues in a way that enhance education. Sociocultural theorists feel that certain aspects of place influence both learning processes and learning outcomes. Physical features, available materials and typical activities connected to place are particularly influential aspects of place (Bell et al., 2009). In environmental education, the natural environment can function as an infrastructure and focus for learning. The natural world, with its place-specific features and processes, focuses environmental inquiry and learning (Bell et al., 2009). For youth from rural areas, informal education that occurs in the natural environment may be especially important. Agricultural lifestyles in rural settings that place youth close to nature and its processes can greatly enhance student understanding of and engagement with the flora and fauna of specific ecosystems (Bell et al., 2009).

The Importance of Place to the Lumbee People

Recent United States Census Bureau data indicate that many Lumbee Indians continue to inhabit rural areas within their homeland situated in Robeson, Hoke, Cumberland, and Scotland Counties of southeastern North Carolina. Seventy-nine percent of the Lumbee residing in these four counties reside in rural areas (U.S. Census Bureau, 2010). Whether they live in rural or urban areas, place is very important to the Lumbee (Lowery, 2009). They believe that they are the descendants of the original inhabitants of eastern North Carolina (Oakley, 2005). Oakley (2005) argued that their historical and present-day connection to this place is inexorably tied to their identity as American Indians:

> Most American Indians, including those in North Carolina, place tremendous importance on a sense of place. They come from here, whereas everyone else comes from somewhere else. Therefore, their identity is intertwined with the local geography. This belief is the primary boundary that separates Indians from others in North Carolina. (p. 12)

Knick (2008) agreed that place culturally bounds the Lumbee. Often several generations of Lumbee families live close together on the same land or “home place,” and therefore establish a network of families and clans (Knick, 2008, p. 87). Lumbees may refer to these localized networks using the traditional “communities” or “settlements” (Blu, 1996), but sometimes, they use the more modern “sets” (Knick, 2008). As was the case with the Lumbee participants at the HREs, among the first questions asked by a Lumbee of a stranger is “Who are your people?” (Knick, 2008, p. 87). Another, almost tandem, early question is “Where do you stay at?” To Lumbees this question means, “Where especially in the homeland region are you living? Where do you come from?” (Blu, 1996, p. 205). The answers to these questions help the Lumbees place each other within a network of families and clans (Knick, 2008). If the answers are not quite satisfactory (e.g., if an accent or family does not seem to fit the designated area), a Lumbee may follow with “Where do your people stay at?” To the Lumbee, “your people” refers to family and is not a gloss for “your race” (Blu, 1996, p. 205). The answers to these questions help new acquaintances “place” each other based on the Lumbee people’s assumptions about the connections between family name, kinship group, and geographic locale, and additionally, the importance of knowing these things about one’s associates (Blu, 1996).

The Lumbee (Lumber) River is another important “place” for the Lumbee People. As the river winds its way through the swamps and farms of southeastern North Carolina, it passes many Lumbee settlements and communities (Locklear, 2010). Because it is navigable and supports a healthy ecosystem, the Lumbee River has had, and continues to have, important cultural and economic roles in the area’s development.

The Lumbee is the site for religious and social events such as baptisms, family gatherings, and other get-togethers. In addition, the river offers other social and recreational activities including swimming, boating, hunting and fishing. The river has economic importance as well. In the 18th and 19th centuries, the lumber products and naval stores that were essential to the well-being of the area’s economy were transported down the Lumbee River. Centuries of dependence on the Lumbee River forged a strong bond between the Lumbee Indian and non-Indian communities of the area. Many Lumbee and non-Indian individuals would contend that this connection to the Lumbee River defines them as a people and as a community (Locklear, 2010). Finally, Blu (1996) argued that "[f]or Lumbees and other Native Americans, the attachment to a particular place or set of places is necessary, not optional, for their group identity. It defines them as a particular people" (p. 224). For the Lumbee, that place is their ancestral homeland as symbolized by Robeson County.

I feel that the SCR HRE is a good example of place-based education, particularly for Lumbee participants. SCR is in the North Carolina Sandhills at the intersection of three of the counties listed above, all of which have substantial Lumbee populations. Therefore, this HRE occurred within the Lumbee homeland. Located on North Carolina's upper coastal plain, the Lumbee homeland contains diverse habitats that include dry turkey-oak communities that are typical of North Carolina's Sandhills, and the dense growths of grasses, herbs, shrubs, and trees that are typical of swamp forest, pocosins, and savannahs (Croom, 1997). Thus, this HRE placed these participants within landscapes and ecosystems that were familiar and integral parts of the locale in which they live.

Communities of Practice (CoP) and Funds of Knowledge (FoK)

I chose to investigate Lumbee participation in IEE using the theoretical frameworks of CoP (Lave, 1991; Lave & Wenger, 1991) and FoK (Moll et al., 1992). I was introduced to these concepts during coursework in my doctoral studies. I introduce these concepts here, and I discuss them in detail in Chapter II.

Communities of practice. A CoP is "an activity system about which participants share understanding concerning what they are doing and what that means in their lives and for their communities" (Lave & Wenger, 1991, p. 98). Learning in a CoP is a situated activity characterized by legitimate peripheral participation (LPP). Learning occurs as members of a CoP master an understanding of the community's collective knowledge and skills. Mastery moves newcomers towards status as old-timers (Lave & Wenger, 1991). Practice forms the nucleus for a CoP's coalescence in three different, but interrelated dimensions: mutual engagement, joint enterprise, and shared repertoire (Wenger, 1998).

Mutual engagement. Humans constantly pursue various enterprises, and learning occurs as people (re)adjust their interactions with one another and their surroundings, thus producing practices that mirror the pursuit of these enterprises. Wenger (1998) argued that these "practices are thus the property of a kind of community created over time by sustained pursuit of a shared enterprise. It makes sense, therefore, to call these kinds of communities "*communities of practice*" (p. 44). CoP members negotiate the meaning of their shared activities, and thus mutual engagement defines CoP membership (Wenger, 1998).

Joint enterprise. Joint enterprise reflects how members work together towards a common end (Li et al., 2009; Nickols, 2012). Joint enterprises are negotiated, indigenous, and have mutual accountability (Wenger, 1998). Joint enterprise is negotiated among the CoP's heterogeneous membership in order to coordinate their practice. Because members respond to its practices, resources and constraints daily, the CoP's joint enterprise is indigenous and results in mutual accountability (Wenger, 1998).

Shared repertoire. With time, the community's joint enterprise develops a shared repertoire of resources that helps members negotiate meaning (Wenger, 1998): words, jargon, tools and techniques, protocols for tool and technique use, community stories, acceptable behaviors and styles, and a shared discourse (Davies, 2005; Li et al., 2009; Nickols, 2012, Wenger, 1998).

Boundaries and peripheries. Eventually, a CoP's shared history of practice produces boundaries between the CoP and other outside communities (Wenger, 1998); these borders may be porous to newcomers (Wenger, 1998). Porosity allows newcomers legitimate access to a practice without the obligations of full membership (Wenger, 1998).

The iterative relationship between a community of practice (CoP) and its participants. LPP applies not only to the participant's transformation due to his/her trajectory within the community; but also implies an iterative interaction between community members, resulting in a change in the community through time (Lave, 1991; Lave & Wenger, 1991). Many studies look at the effect of a CoP on its newcomers (Aguilar & Krasny, 2011; Hay & Barab, 2001; Olitsky, 2007; Richmond & Kurth, 1999; Ritchie & Rigano, 1996), but few assess the effects of newcomers on their community. Studies that do both include Calabrese Barton, Tan, and Rivet (2008) and Ash et al. (2015) which document both effects.

Funds of knowledge. In a seminal work on FoK, Moll et al. (1992) investigated the knowledge and skills of Mexican-American working-class communities in Arizona. Moll et al. (1992) “use[d] the term ‘funds of knowledge’ to refer to these historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being” and argued that “ household knowledge may include information about farming and animal management, associated with households’ rural origins, of knowledge about construction and building, related to urban occupations, as well as knowledge about many other matters such as trade, business, and finance on both sides of the border” (p. 133).

Educational researchers have used the FoK concept to study both formal (school) and informal science in the United States and abroad. Hammond (2001) reported how a team of bilingual/multicultural elementary teacher-educators, pre-service teachers, students, and community members in California employed the FoK of the local Mien refugee community to build a Mien garden house. This collective used science topics meaningful to the Mien community as starting points, but during the construction, community-based materials were generated that paralleled and complemented the standards-based science curriculum (Hammond, 2001). Upadhyay (2006) described how Jane, a White teacher in a predominantly Hispanic urban school, used the FoK framework to incorporate the lived experiences of her students to teach meaningful science. Lloyd (2010) studied a rural watershed research project conducted by an out-of-school science club. She identified several FoK that students used to design and carry out this project. In New Zealand, Indigenous Maori individuals are overrepresented in underperforming schools. Researchers found that when the FoK of Maori culture were incorporated into classroom pedagogy, Maori students' engagement and participation in science activities, both inside and outside the classroom, improved (Cowie, Jones, & Otrel-Cass, 2011).

Herpetological Research Experiences (HREs) as a Joint Enterprise of The Herp Group (THG)

Historically, THG developed over several years as the result of collaborations and chance meetings of people who had differing expertise in herpetological field practices, but who shared a passion for making these practices accessible to high school students. In Chapter II, I provide a detailed history of the development of THG, including information about founding members, their areas of expertise, and other THG enterprises.

The initial purpose of THG was to administer HREs. The initial HRE, and other intermediate HREs that were held over four successive years (2007 to 2010), morphed into the HRE that is the focus of this study. HREs were initially held at Hickory Hills Camp and Retreat Center (HHC, a pseudonym) in the rural Piedmont of North Carolina from 2007 to 2015. These HREs were designed to introduce participants to: native North Carolina reptiles and amphibians, the practices of scientists engaged in herpetological fieldwork, and possible careers in ecology and herpetology. Initially, HRE instructors included three university faculty members in science and science education, environmental education center staff, and several special returning guests including professional herpetologists. During the course of these HREs, old-timers coalesced into a herpetological CoP that invited and welcomed newcomers (high school students, as well as other scientists and other science educators) into the joint enterprises of THG (environmental issues in general, and herpetological research issues in particular).

Significance of and Rationale for this Study

Throughout their history, the Lumbee Indians have experienced chronic challenges in the education of their youth. Although the informal learning practices of any culture can lead to both systematic and reliable knowledge about the natural world (Bell et al., 2009), I could not document any instances of informal educational enhancement, such as the HRE experience referenced above, for Lumbee youth. Learning about the natural world and subsequent development of science skills continues throughout an individual's lifespan (Bell et al., 2009). The Committee on Learning Science in Informal Environments (CLSIE) performed what is perhaps the definitive study of ISE (Bell et al., 2009). CLSIE highlighted the potential impact of ISE for underrepresented groups, such as the Lumbee, with their Conclusion 9: "Informal environments can have a significant impact on science learning outcomes for individuals from non-dominant groups who are historically underrepresented in science" (Bell et al., 2009, p. 310). Further, CLISE argued that a better understanding of science learning in "non-dominant and dominant cultures is needed to inform basic theory and to design learning experiences that meaningfully attend to the cultural practices of diverse groups" (Bell et al., 2009, p. 313).

This study is an example of place-based ISE. Few studies have discussed CoP concepts in such circumstances, but CLSIE suggested that a CoP framework might be used to guide the development and assessment of community based efforts for ISE (Bell et al., 2009). They posited that this framework offers insight into participants' trajectories from science novices to more active and central members of the science CoP. During their trajectories, participants engage in authentic science and sometimes participate in apprentice-like activities with scientists, engineers, and technicians (Bell et al., 2009). For the reasons listed above, this dissertation is a significant addition to the science education literature concerning CoPs, education of minority communities, and informal place-based education. The findings presented here may be of interest to any educator; formal, informal, or environmental, who is looking to help all students build a space for science learning that bridges school and student cultures.

Research Questions

Based on my belief that the Lumbee HRE participants came from a distinctive rural background with authentic FoK, and because I felt that the SCR HRE functioned as a CoP in which these Lumbee youths experienced enhanced trajectories and made significant contributions, I addressed the following research questions:

1. What FoK did these Lumbee youths bring to the SCR CoP? *(FoK)*
2. How did these Lumbee youths come to have these FoK? *(Source)*
3. How did these Lumbee youths leverage their FoK? (*Leverage*)
4. How did these Lumbee youths contribute to the SCR CoP? *(Contributions)*
5. How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? *(Benefits)*

Research Design

My research was a case study with a single case (Creswell, 2007) that employed a mixed methods, ethnographically inspired design (Creswell & Plano Clark, 2011). Ethnographic studies can employ both qualitative and quantitative data strands (Creswell & Plano Clark, 2011, Willis, 2007). An embedded design mixes the collection and analysis of both qualitative and quantitative data within a traditional research design. Mixed methods ethnography is an embedded design variant (Creswell & Plano Clark, 2011). In this study, the qualitative data strand was primary, and the quantitative data strand was supplementary (Creswell & Plano Clark, 2011). Within my embedded design, I collected and analyzed both quantitative and qualitative data during the same phase of the research process. Subsequently, I merged the qualitative and quantitative data into an integrated interpretation of the research findings.

Qualitative data were collected by audiotapes, digital videos and field notes during the entire week of the SCR HRE. Educational researchers made field notes as they observed each of the daily field activities (discussed in detail in the methods section, Chapter IV). Additionally, educational researchers and other HRE staff digitally videotaped and/or audiotaped episodes of participation that they felt were significant and that occurred during these field activities. Similarly, HRE educational researchers and staff recorded night electives as appropriate (discussed in detail in the methods section, Chapter IV). A final source of qualitative data was the individual Youth Interview Protocol (Appendix E). This protocol was used to interview SCR HRE participants on Thursday afternoon.

Qualitative data types were prepared in different ways. Handwritten field notes were typed into MS Word documents. Interviews were transcribed from audio files into MS Word documents. Digital audio files and videos were compressed and uploaded to the THG server. I downloaded the audio and video files from the server, and transcribed the pertinent portions of these files into Microsoft (MS) Word documents. Once all media files were in MS Word format, I uploaded them to Dedoose, a qualitative data exploration and analysis software program (Dedoose software). After I uploaded these MS Word file transcripts, I excerpted and coded text. I created memos that helped me develop codes and themes using open and axial coding (Corbin & Strauss, 2014). Emerging themes were sought that helped describe participants' FoK brought to the HRE, and to explain the participants' ability to function within the HRE CoP. Qualitative methods will be discussed in more detail in Chapter V.

One source of quantitative data was the pretest/post-test for the SCR HRE (Appendix A). This test was designed to indicate HRE participants' knowledge of such things as herpetology, scientific tools used in herpetological field studies, and participants' ability to identify species of amphibians and reptiles. Quantitative data were also collected using the pre-survey for the SCR HRE (Appendix B). Among other things, this survey was administered to collect data on participant demographics, prior science experiences, out-of-school activities, views of science, reasons for attending the SCR HRE, and prior performance in school science. A third source of quantitative data was the post-survey for the SCR HRE (Appendix C). This survey gathered quantitative data about how the SCR HRE affected the participants' feelings and attitudes towards science in general, herpetology specifically, and how the HRE affected the participants' views of themselves. This survey also gathered data about how the participants felt about the SCR HRE. I analyzed quantitative data using Minitab Statistical Software (Minitab, 2010). Quantitative methods will be discussed in more detail in Chapter VI.

Limitations of the Study

While this study provides insights into how the FoK of rural Lumbee youth can affect the CoP in an informal herpetological field setting, it may have limited use in furthering our understanding of CoPs in broader or more formal settings. This study was restricted in scope to the weeklong SCR HRE held July 10 to 15, 2012, and to nine Lumbee Indian youths (six males and three females) who attended this HRE. My results were focused on these nine individuals only. Therefore, two limitations of my study were (a) the short duration of the HRE, and (b) the limited number of participants. The Lumbee participants were distributed by grade level as follows: seven rising ninth graders, one rising tenth grader, and one rising 11th grader. Thus, the age distribution of my research population was another limitation.

It is important to recognize that there is not an ubiquitous American Indian culture. Thus, my findings are applicable only to these Lumbee Indian students.
The science practices of these Lumbee youths may not be generalized as indicative of an assumed "one, single unified 'Native' science" (Brayboy & Castango, 2008, p. 733). Nevertheless, despite these limitations of my study, I document the FoK that these nine Lumbee American Indian youths brought to the HRE, and show how these FoK allowed

these youths to be significant contributors to this particular SCR CoP. Similar contributions by Lumbee youths have been documented by others (Ash et al., 2015).

Summary and Organization of the Dissertation

The purpose of this mixed methods study was to investigate the participation of Lumbee youths in a specific HRE for rising ninth through 12th graders. The participation of these Lumbee youths was studied within the framework of CoP and FoK. This study investigated how the FoK of these Lumbee youths helped them make contributions to the HRE CoP. In turn, the study investigated the affordances that the HRE provided these Lumbee youths as they learned about reptiles and amphibians specifically and science generally.

This study employed a mixed methods, ethnographically inspired design that combined qualitative and quantitative data to examine the research questions described above. Qualitative data was gleaned from field notes, audio files, and video files that documented the Lumbee youths' participation in all aspects of the daily activities of the HRE. Additional qualitative data were distilled from interviews. Quantitative data were derived from pre- and post-tests of participants' herpetological knowledge, and from pre- and post-surveys of participants' attitudes.

In this chapter I provided my conceptual framework, a summary of operational definitions, a list of basic research questions, and an overview of the research design. The remainder of the dissertation is organized into six chapters. I provide a review of the pertinent literature in Chapter II and a brief history of Lumbee American Indians in Chapter III. In Chapter IV, I describe the methodology used for my study, and in Chapter

V, I present and discuss the qualitative findings of my research. In Chapter VI, I present the quantitative findings from my study. In Chapter VII, I provide signature FoK for individual Lumbee participants, discuss the major integrated findings of my study, possible directions for future research, and limitations of my research design.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

In this chapter I explore the historical and educational underpinnings of the conceptual framework that guided my research. I discuss CoPs and their use in science education. I then define FoKs and their use in science education. This section is followed by a discussion of Lumbee practices, including Lumbee English, which could be interpreted as FoK, with particular reference to Lumbee sense of place. I then justify my assertion that the HREs described in this dissertation function as CoPs.

Communities of Practice (CoP)

Operational Definition of Communities of Practice (CoP)

Wenger, McDermott, and Snyder (2002) speculate that CoPs were humanities' "first knowledge-based social structures" (p. 5); and humans employ them "at work, at school, at home, in [their] hobbies" (p. 5). CoPs are groups of people who share concerns and passions for what they do (Wenger, 2006). CoPs involve participants "in an activity system about which participants share understanding concerning what they are doing and what that means in their lives and for their communities" (Lave & Wenger, 1991, p. 98). CoPs can form around any realm of human endeavor (Lave & Wenger, 1991; Wenger, 1998, 2006; Wenger et al., 2002).

There are many forms of CoPs (Wenger et al., 2002). While some are small, with closely acquainted members, other communities have hundreds of members. These communities can be homogenous or heterogeneous in terms of the disciplines or avocations of their membership (Wenger et al., 2002). The development of a communities' practice requires time; but CoPs vary in duration. European artisan guilds of the Middle Ages lasted for centuries, but other communities may exist for only a few years. As practice sharing requires regular interaction, many communities may start locally. However, established CoPs may exist over much larger areas (Wenger et al., 2002).

Scientific CoPs are global with communication historically by letter, but now by internet (Wenger et al., 2002). Wenger et al. (2002) posit that what constitutes scientific knowledge is the prerogative of the CoP. These communities interact to validate facts and theories. Although scientists may disagree, through communal involvement they develop a body of knowledge. Participation in these communities (even unorthodox participation that goes against the majority opinion) allows members of the scientific community to produce scientific knowledge (Wenger et al., 2002).

When individuals join a CoP, they proceed through an extensive and ongoing learning process that moves them on a trajectory from newcomer to old-timer. Lave and Wenger (1991) term this process as limited peripheral participation (LPP). Mastery of the community's knowledge and skills results from a newcomer's trajectory towards full membership. LPP applies not only to the participant's transformation resulting from his/her trajectory within the community; but also implies a change in the community as new peripheral participants (newcomers) are transformed through time (becoming old-timers) (Lave, 1991; Lave & Wenger, 1991). Thus, there is an iterative and reciprocal relationship between a CoP and its participants. The participants are transformed as they learn through LPP; however the CoP is also transformed as newcomers evolve into old-timers and contribute to the CoP (Lave & Wenger, 1991).

Situated Learning and Legitimate Peripheral Participation (LPP)

Interestingly, Lave and Wenger (1991) did not initially define a CoP, but rather provided an implicit definition by characterizing it in terms of LPP. Lave and Wenger (1991) viewed learning as situated activity definitively characterized by LPP. In this view, learning occurs as the members participate in a community of practitioners, and mastery of the community's knowledge and skills occurs as members follow a trajectory from novice towards fuller membership. Lave and Wenger used LPP to describe "the relations between newcomers and old-timers, and about activities, identities, artifacts, and communities of knowledge and practice" (Lave & Wenger, 1991, p. 29). Becoming part of a CoP engages a person's intentions to learn, and the meaning of learning is organized as that person becomes a fuller participant in any given socio-cultural practice. In this process, the learning of knowledgeable skills becomes indistinguishable from LPP (Lave & Wenger, 1991).

From apprenticeship to situated learning. Apprenticeship learning as LPP first appeared in Lave's research on Liberian tailors (Lave & Wenger, 1991). Describing the results of her research, Lave conceived LPP as a mechanism by which tailors' apprentices learned without direct instruction while engaging in common, structured learning experiences as they transformed into skilled tailors. However, Lave and Wenger (1991) shifted from this perspective seeking to distinguish between historical forms of apprenticeship and the historical-cultural theory of situated learning. Lave and Wenger (1991) became convinced that apprenticeships, as historically defined, were an important resource for understanding situated learning because they felt apprenticeships captured the "transformative possibilities of being and becoming complex, full cultural-historical participants in the world – and it would be difficult to think of a more apt range of social practices for this purpose" (p. 32).

As Lave and Wenger (1991) developed a broader concept of situated learning, their distinction between historical cases of apprenticeship and a theory of situated learning strengthened. Their concept of situated learning became a general theoretical perspective in which "the basis of claims about the relational character of knowledge and learning, about the negotiated character of meaning, and the concerned (engaged, dilemma-driven) nature of learning activities for the people involved" (Lave & Wenger, 1991, p. 33) evolved. Their new perspective meant that all activity is situated, and additionally

> implied emphasis on comprehensive understanding involving the whole person rather than 'receiving' a body of factual knowledge about the world; on activity in and with the world; and on the view that agent, activity, and the world mutually constitute each other. (Lave & Wenger, 1991, p. 33)

From situated learning to legitimate peripheral participation (LPP). Another shift in perspective led Lave and Wenger (1991) to an exploration of learning as LPP. They began to view situated learning as a transition between two views of learning (Lave

& Wenger, 1991). In the first view, cognitive processes (learning) are of primary importance, and learning subsumes practice. In contrast, the second view gives primacy to social practice, and "learning is not merely situated in practice – as if it were some independently reifiable process that just happened to be located somewhere; learning is an integral part of generative social practice in the lived-in world" (Lave & Wenger, 1991, p. 35). Further, Lave and Wenger (1991) postulate LPP to describe engagement in social practice that involves learning as a necessary ingredient.

Lave and Wenger (1991) state that the three words that constitute the term LPP must be considered as an inseparable whole, each necessary to define the other. Therefore, it would be wrong to interpret these words in contrasting pairs: legitimate vs. illegitimate, peripheral vs. central, participation vs. non-participation. There is no concept of an illegitimate peripheral participant. Legitimate participation definitively characterizes ways of belonging to a CoP. Legitimate participation, therefore, is crucial to learning. In addition, peripherality indicates that there are numerous roles that a participant can perform in a community's practice as "[p]eripheral participation is about being located in a social world [and c]hanging locations and perspectives are part of actors' learning trajectories, developing identities, and forms of membership" (Lave & Wenger, 1991, p. 36). Just as a CoP has no designated periphery, there is no single center in relation to a member's evolving location in the complex, heterogeneous community. Use of the term "central participation" would imply such a center. Lave and Wenger (1991) prefer to say that peripheral participation leads to full participation. This term indicates the multiple relations involved in changing forms of community membership.

However, stating that peripheral participation leads to full participation does not imply that newcomers' partial participation is irrelevant to the community's activities. Peripherality is a positive term that when "enabled, suggests an opening, a way of gaining access to sources for understanding through growing involvement" (Lave & Wenger, 1991, p. 37).

Legitimate Peripheral Participation (LPP) as an Analytical Perspective on Learning

Lave and Wenger (1991) emphasized that LPP is not an educational form, nor a pedagogical strategy. In their opinion, LPP is an analytical viewpoint that may be used to understand learning. They contend that learning through LPP occurs in any educational context, and even in the absence of an institutional educational setting. There is a fundamental difference between learning and intentional instruction. They do not deny that learning takes place during instruction, but contend that intentional instruction is not the sole path to learning. Lave and Wenger (1991) emphasize that LPP should not be used as a method of instruction or a way of designing instructional programs, but rather it should be used as an additional tool for understanding learning processes in a group situation. Whether involving an apprenticeship or a classroom, the CoP is organized around a body of knowledge that is the property of the community. Such a body of knowledge can be termed a curriculum (Lave & Wenger, 1991).

A learning curriculum. A learning curriculum is a necessary characteristic of a CoP, and is different than a teaching curriculum. A teaching curriculum is developed for the instruction of newcomers and leads to didactic teaching that describes a proper practice that in turn creates a uniform mode of participation. Members are thus prevented from participating in ongoing practice and therefore are denied legitimate learning opportunities (Lave & Wenger, 1991). As learners comply with the requirements of didactic teaching, a practice other than intended is created. Learning still occurs in these circumstances through LPP, but occurs outside of the intended target practice. A teaching curriculum has been created, and the meaning of learning is mediated by the teacher's participation. The students receive an external view of learning. By contrast, "[a] learning curriculum is essentially situated" (Lave & Wenger, 1991, p. 97). A learning curriculum is not manipulated arbitrarily, not didactic, nor isolated from the social relationships that determine LPP. A learning curriculum is a "field of learning resources in everyday practice *viewed from the perspective of learners"* and is "thus characteristic of a community" (Lave & Wenger, 1991, p. 95).

Characteristics of Communities of Practice (CoP)

Diverse membership. A CoP does not imply a common culture, a distinctly identifiable group, or socially distinct borders. Rather, the members of a CoP have varied interests and viewpoints; they contribute to the community's activity to varying degrees. Lave and Wenger (1991) argue that varying degrees of participation is a necessary part of membership in a CoP. What a CoP does imply is "participation in an activity system about which participants share understandings concerning what they are doing and what that means in their lives and for their communities" (Lave & Wenger, 1991, p. 98).

Discourse. Discourse among participants plays a key role in the practices of the community. As newcomers move toward fuller participation, they learn when and how to talk or be silent (Lave & Wenger, 1991). Newcomers must to learn to talk within and about a practice. Talking within includes the exchange of information that is necessary for the progression of ongoing activities. Talking about includes the retelling of community stories and lore (Lave & Wenger, 1991). Within the practice both types of talk have specific functions: engaging, focusing and shifting attention; coordinating efforts; providing for group memory and reflection. Engaging in the community's discourse signals community membership. Therefore, newcomers do not learn from talk as a substitution for LPP, rather learning the community's discourse provides entry to LPP (Lave & Wenger, 1991).

Practice. Wenger (1998) expanded the description of communities of practice by associating practice with the formation of communities. He noted that practice implies doing, but in a historical and social context that provides a framework and an understanding of what we do. Therefore, practice always has a social component. This view of practice includes things that are said and things that are left unsaid; it includes things such as language, symbols, tools, and well-defined roles. Tying practice to community delineates practice from other concepts such as culture, activity and structure (Wenger, 1998). The connection between a community and practice defines a distinct type of community: a CoP. There are three different ways in which practice is connected to a given community: mutual engagement, joint enterprise, and shared repertoire (Wenger, 1998).

Mutual engagement. Mutual engagement is defined as the shared practices that community members perform. The community as a whole defines these practices. Although the community's practice may involve the use of numerous tools and artifacts, the practice does not dwell in the tools or artifacts. While practice does not develop in a historical vacuum, it does not evolve from preceding structure. Practice exists in a community of participants and the relationships of mutual engagement that enable them to perform their practice (Wenger, 1998).

Joint enterprise. Joint enterprise has three aspects (Wenger, 1998): 1. Joint enterprise is negotiated. Joint enterprise does not mean that all participants share the same beliefs or agree with everyone. Rather, the joint enterprise is negotiated among participants. The participants do not share the same conditions and dilemmas, nor do they have similar responses to situations. Participants' reactions to their varying circumstances interconnect as they engage in their community's practice. The members must negotiate their differences in order to coordinate their practice (Wenger, 1998). 2. Joint enterprises have an indigenous nature. Having their own specific resources and/or constraints, communities of practice develop within larger historical, social and institutional contexts. Although the community's practice may be influenced by outside forces beyond the community's control, the community's reality is created within the limits of its own resources and/or constraints. The community responds to its own conditions and the resulting enterprise belongs to the CoP (Wenger, 1998). 3. Joint enterprises demonstrate mutual accountability. Mutual accountability evolves as a CoP negotiates a joint enterprise: what facts do and do not matter, what is and is not important, what to do and not to do, what to talk about and what not to talk about (Wenger, 1998).

Shared repertoire. With time, the community's joint enterprise develops a shared repertoire that helps negotiate meaning (Wenger, 1998). The repertoire's elements may be heterogeneous and have no intended value as activities, symbols or artifacts. Rather, the elements of the shared repertoire are valuable as they belong to a CoP pursuing an enterprise. A shared repertoire includes such things as routines, words, tools, ways of doing things, and stories that the community either produced or adopted during its history, and are now part of its practice (Wenger, 1998).

The Iterative Relationship between a Community of Practice (CoP) and Legitimate Peripheral Participation (LPP)

Hanks (1991) posited that Lave and Wenger's (1991) work takes learning out of the individual mind and places it in a participatory framework. Thus, the varied perspectives of different participants mediate learning. Within this model, it is the community (or at least those participating in the learning activity) that learns (Hanks, 1991). Perhaps the apprentice experiences the most transformation by fuller participation, but the CoP is pivotal in this transformation. Hanks (1991) argued that the CoP reproduces itself through the production of apprenticeships; it is simultaneously transformed by this interaction.

LPP should not be viewed as only applicable to the transformation of a participant as a result of their centripetal trajectory within the community; it also implies a process of community change and reproduction as new peripheral participants are transformed through time (Lave, 1991; Lave &Wenger, 1991). Thus, there is an iterative and reciprocal relationship between a CoP and its participants. The participants are transformed as they learn through LPP; however the CoP is also transformed as newcomers move toward becoming old-timers.

Communities of Practice (CoP) in Science Education

Many studies look at the effect of CoPs on newcomers, but few assess the effects of newcomers on the community. Lave and Wenger (1991) discuss the effects of LPP on newcomers' learning and acquisition of knowledge, but only briefly address the reciprocal effects of newcomers on the community. Influenced by Lave and Wenger (1991), science education researchers studied student participation in scientific CoP's. However, these studies also seem to pay little heed to the effects of newcomers on the community. Ritchie and Rigano (1996) reported on the trajectory of "two elite high school science students" (p.803) who participated within a chemical engineering research laboratory community under the mentorship of volunteer scientists. Although originally viewing their mentors as experts, these students were able to take control of their own projects after prolonged collaborative practice (Ritchie & Rigano, 1996). Beyond discussing the students' academic credentials and that they worked collaboratively with each other during their research at the laboratory, the authors do not discuss the contributions made by these newcomers to this laboratory community (Ritchie & Rigano, 1996). In another study that placed students in a scientific community, Richmond and Kurth (1999) reported on the participation of tenth- and 11th-grade Americans and Samoan Americans in a seven-week-long residential summer research program that paired students with a research mentor. Based on analysis of qualitative data gathered on seven student participants, the authors concluded that as students moved from the periphery of this scientific community towards its center, their appreciation of what it meant to do science became more complex and realistic. However, Richmond and Kurth (1999) make no mention of the contributions these students made to the scientific CoP beyond commenting that the students seemed to work collaboratively with each other and members of the laboratory.

Hay and Barab (2001) looked at “learning by doing” in social contexts and how these concepts might enhance the education of middle school science students. Students were assigned to teams that followed the practices of research scientists at a large midwestern university during a two-week period in the summer. Hay and Barab (2001) were able to identify three nested learning structures within the study. The most encompassing learning structure was the entire group that engaged in group lunches, newsgroup activities and presentations. Hay and Barab (2001) were able to show evidence for participatory learning at the camp as students engaged in practice with and under the guidance of the scientists. Scientists supported students in becoming more knowledgeable in their scientific skills by initially modeling practice, and also by sharing previous research with the students. Despite the limited nature of their participation, the students frequently viewed their actions as authentic. Students seemed to become members of a CoP; they moved along a trajectory that was evident, and overall the learners felt they had a legitimate role in the scientists’ research programs, and that their role became more central as they mastered requisite skills. It is important to note that this paper gives many evidences of a CoP affecting its newcomers, but nowhere do the authors (Hay and Barab, 2001) demonstrate that the newcomers affected the community in a significant way.

More recent science education literature seems to demonstrate a lack of research on the effects of newcomers on their communities. Olitsky (2007) studied the importance of interaction rituals in an eighth grade science class in an urban magnet middle school. She reported that successful interaction rituals fostered engagement, feelings of group membership, and sustained interest for science topics, all of which moved this class towards becoming a CoP. Although Olitsky (2007) notes the importance of newcomer participation, her emphasis is on the benefits of participation for the student or newcomer. How newcomers affected community change is not discussed beyond student support of peer learning.

Kisiel (2010) investigated the relationship between an aquarium and an elementary school. However, Kisiel (2010) assessed the effects of overlapping CoPs on one-another, but did not assess the effects of newcomers on either community.

Aguilar and Krasny (2011) studied an after-school environmental education program for Hispanic youth in seventh and eighth grades using the CoP framework. They attempted to determine if this after-school program exhibited Wenger's (1998) three attributes that define a community of practice: joint enterprise, shared repertoire, and mutual engagement. The researchers studied three schools involved in an environmental club (EC) program. The EC program, which included schools along Texas' Gulf Coast, was designed to connect U.S. and Latin American communities around common concerns for the Gulf of Mexico. In the ECs at all three schools, the researchers recognized and described Wenger's (1998) three characteristics of communities of practice during their analysis of group interviews, individual student interviews, and student drawings (Aguilar & Krasny, 2011). The authors also concluded that during focus group and individual interviews, the participants recognized Wenger's three characteristics within their groups, and differentiated communities of practice from mere communities. While the authors clearly designate the ECs as communities of practice, they did not explicitly discuss how the individual students made contributions to their communities of practice (Aguilar & Krasny, 2011).

This review demonstrates minimal science education literature that discusses the contributions of newcomers to a CoP. However, I believe that a study by Calabrese Barton et al. (2008) present examples of how participants contributed to their CoP as they gained more central positions. Interestingly, this study also draws on the FoK framework to explain that participant's contribution.

Calabrese Barton et al. (2008) looked at the science practices of middle school girls from three different high-poverty, urban schools to understand how these girls negotiated their science identities and positions in their science classroom communities. Calabrese Barton et al.'s (2008) theoretical construct involves hybridity theory. Hybridity theories conceive that students meld their first space (educational space) with a second space (household social world) to create a hybrid third space that allows them to make sense of their world (Moje et al., (2004), as cited in Calabrese Barton et al., 2008). The authors wished to understand how youth participate in/contribute to the third space in a science class in order to support their learning. They drew upon the lenses of practice and identity derived from the socio-cultural perspectives of Lave and Wenger (1991). Calabrese Barton et al. (2008) characterize science classrooms as CoPs. By studying science practices, Calabrese Barton et al. (2008) felt that they began to comprehend how these girls constructed hybrid spaces that maintained their attempts to create new forms of participation that helped them successfully merge their social identity with the world of their classroom.

Although Calabrese Barton et al. (2008) identified several practices they speculated helped these girls develop hybrid spaces, they only describe three. I will describe one of those practices and one girl's enactment of that practice as germane to my thesis: signature science artifacts. Signature science artifacts are actions related to the girls' classroom practices which are interpreted through the lens of an individual girl's life, interests or talents. A girl would take a class assignment or a bit of instruction and meld it with her personal life or interests to produce a hybrid construct that would interpret learning in a new way. The girls' constructions of hybrid spaces drew upon a combination of their social resources (i.e., musical talent, knowledge of popular music, dancing ability), along with traditional classroom science resources (i.e., textbooks or ideas discussed in class). These constructs become a part of the practice of the classroom community.

As an example, one of the girls (Ginny) built upon a classroom assignment to make flashcards for the bones of the body and transformed it into an exercise wherein she danced as she sang the names of the bones to a popular song. This hybrid construct was so effective, that her teacher typed her song and distributed it to all his other sixth grade classes (Calabrese Barton et al., 2008). Ginny used her social resources to sing and dance her way into a central position in her science classroom community. Her centrality is evidenced by the role of her song as a way of memorizing the bones of the body. Ginny's bone song validated her use of nontraditional (social) resources for doing science, and these resources were integrated into the everyday talk of her classroom and the other sixth grade science classrooms as well. I believe that Ginny and her bone song and accompanying dance demonstrate the iterative and reciprocal relationship between a CoP and its participants. As a participant, Ginny transformed her science classroom's CoP as she gained a more central position. However, Ginny was transformed by her participation as well. She scored 95% on her bone test, and four months later she was still able to perform her song and dance in its entirety (Calabrese Barton et al., 2008).

Calabrese Barton et al. (2008) classify the nontraditional social resources that Ginny and the other girls leverage to create hybrid spaces to support their science learning as FoK. Calabrese Barton et al. (2008) view FoK as the ways of being and the practices that these young girls bring to the science class from their social worlds. These ways of being are tied to their personal social life and include such characteristics as "caring for others, care for work produced, self-reliance, [and] verve" (Calabrese Barton et al., 2008, p. 98), as well as practices that they are afforded by talents such as musical and artistic ability. The ways of being and practices these girls bring to class may have developed in conjunction with the ethnicity of their households, but Calabrese Barton et al.'s (2008) focus seems to be on the individual girls' FoK as opposed to household practices that form the basis of Moll et al.'s (1992) seminal framework of FoK.

Funds of Knowledge (FoK)

Development of Concepts Related to Funds of Knowledge (FoK)

FoK has anthropological roots (Hogg, 2011). Wolf (1966) originally coined the term in defining the resources and knowledge deployed and employed by household members to try and ensure their household's economic survival, and these funds included caloric funds, funds for rent, replacement funds, ceremonial funds, and social funds (Wolf, as cited in Hogg, 2011, p. 666). Vélez-Ibáñez (1988) conducted an ethnographic study of economically compromised communities in Mexico and the United States, and during his study he drew on Wolf's definitions (Hogg, 2011). Vélez-Ibáñez (1988) identified many FoK within these communities. These FoK included:

> information and formulas containing the mathematics, architecture, chemistry, physics, biology, and engineering for the construction and repair of homes, the repair of most mechanical devices including autos, appliances and machines as well as methods for planting and gardening, butchering, cooking, hunting, and of 'making things' in general. Other parts of such funds included information regarding access to institutional assistance, school programs, legal help, transportation routes, occupational opportunities, and for the most economical places to purchase needed services and goods. (p. 38)

Velez-Ibanez's (1988) work inspired a team of anthropology and education academics based at the University of Arizona in Tucson, and this group readily understood that both Velez-Ibanez's (1988) concept and findings were germane to school contexts. This group has included Carlos Velez-Ibanez, Luis Moll, Norma González, James Greenberg, Cathy Amanti, Cecilia Rios-Aguilar (Hogg, 2011).

Funds of Knowledge (FoK) as Practices

González et al. (2005a) reported that while developing their FoK concept, they avoided the use of the word "culture." Using the concept of culture was problematic as it implied adherence to group norms and a lack of ability to change one's worldview. Rather, González and colleagues (Moll et al., 1992; González et al., 2005a; González, 2005) chose to focus on practice (González et al., 2005a). They defined practice as what households do and think about what they do. Using practice helped González et al. (2005a) to elucidate the interculturality of households. González (2005) states that she and her colleagues used processual approaches to culture. Processual approaches focus on everyday processes or daily activities as a frame of reference. Thus, daily activities are manifestations of the historically accumulated FoK within a particular household rather than the performances of an essentialized group. Viewed from a time-oriented perspective, process is continuous and changing, rather than static and unchanging. Household practices are dynamic, emergent, and interactional (González, 2005).

While Moll et al.'s (1992) description of FoK was restricted to household activities, it is important to note that the concept of "practice" or activity is critical to their concept. Also, they conclude that household FoK are dynamic and changing; able to adapt to novel situations. For these reasons, it is easy to see why researchers dealing with educational CoPs would use FoK as a good way of explaining CoP learning and knowledge construction. CoPs develop, retain, and modify FoK in a manner analogous to Moll et al.'s (1992) households.

Funds of Knowledge (FoK) in Education

Seminal studies of funds of knowledge (FoK). Moll and Greenberg (1990) conducted ethnographic studies of households within a Hispanic community of mostly Mexican descent near Tucson, Arizona. They also studied an elementary school attended by these households' children. The emphasis of their analysis concerned labor and household practices. They focused specifically on the labor-related activities that occur within and between households, and how children participated in these activities. They hoped their study of households and household pedagogy would inform the creation of innovative classroom pedagogy by the community's schoolteachers. Toward this goal, Moll and Greenberg (1990) endeavored to establish reciprocal relationships between the labor practices that children engage in at home and instruction at school.

Moll and Greenberg's (1990) study consisted of three parts: 1. An ethnographic analysis of the transmission of knowledge/skills among these Hispanic households. 2. The creation of an afterschool laboratory where the teachers and researchers experimented with using the community information in conjunction with literacy instruction. 3. An analysis of classroom instruction designed to ascertain existing methods of literacy instruction and exploration of how to change these methods using what was learned from the study of the classrooms and also the study of the households.

Moll and Greenberg's (1990) ethnographic analysis of these households concentrated on the pervasive, significant socio-cultural practices and activities that they referred to as *confianza.* These reciprocal social relationships joined these households into networks of social clusters. These networks are social constructs that transmit knowledge, skills, information, cultural values and norms (Moll & Greenberg, 1990). The most important function of these clustered households is that they share and exchange FoK (Moll & Greenberg, 1990). FoK can be viewed as "an operations manual of essential information and strategies households need to maintain their well being" (Greenberg, as cited in Moll & Greenberg, 1990, p. 323).

The multiple relationships between the families in the community studied by Moll and Greenberg (1990) contrast sharply with the constricted and narrow teacher-child relationship found within the children's classroom. In contrast to these household networks, classrooms were relatively isolated. The content and process of exchanging FoK was useful in instruction (Moll & Greenberg, 1990). By developing social networks to connect classrooms with outside resources, through mobilizing FoK, classrooms were transformed for both teaching and learning.

An indispensable element of their approach for developing innovative teaching was building meaningful connections between the students' academic and social lives by using the concrete learning activities of the student (Moll & Greenberg, 1990). The students' community and its FoK were the most important resources for building this connection. Moll and Greenberg (1990) were convinced that teachers could establish relationships with outside communities in order to change and improve their pedagogy. The social connections would help "teachers and students to develop their awareness of how they can use the everyday to understand classroom content and use classroom activities to understand social reality" (Moll & Greenberg, 1990, p. 346).

Moll et al. (1992) report on a collaborative study conducted by an educational researcher (Moll), two teachers (Amanti and Neff) and an anthropologist (González) who investigated Mexican-American working-class communities in Tucson, Arizona in order to study household and classroom practices. The purpose of their investigation was to develop innovative teaching techniques that tapped into the knowledge and skills of these local communities. Their investigation included ethnographic observations, life histories and case studies that helped them reveal the complex functions of households within these communities. Moll et al. (1992) also studied the history of the American-Mexican border region in order to gain a fuller understanding of the social, political, and economic contexts in which these households are situated to disclose the accumulated bodies of knowledge within each household. They felt it was particularly important to study the labor history of families, as children were often active within household labor practices. Moll et al. (1992) "use[d] the term 'funds of knowledge' to refer to these historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (p. 133), and argued that

> household knowledge may include information about farming and animal management, associated with households' rural origins, or knowledge about construction and building, related to urban occupations, as well as knowledge about many other matters, such as trade, business, and finance on both sides of the border (p. 133).

Moll et al. (1992) observed that children in these households were not passive observers as they were often viewed in their classrooms. Rather, these children were active participants in a broad range of activities that were mediated by the various social relationships within the context of their homes and communities. Moll et al. (1992) observe that "within these contexts, much of the teaching and learning is motivated by the children's interest and questions; in contrast to classrooms, knowledge is obtained by the children, not imposed by the adults" (p. 134). This observation is important as these children were often viewed within their classrooms as "poor"; not just in economic terms, but also in terms of the quality of household and community experiences. In contrast, Moll et al. (1992) argued that

> [our] analysis of FoK represents a positive (and, we argue, realistic) view of households as containing ample culture and cognitive resources with great, *potential utility* for classroom instruction. This view of households, we should mention, contrasts sharply with prevailing and accepted perceptions of working-class families as somehow disorganized socially and deficient intellectually; perceptions that are well accepted and rarely challenged in the field of education and elsewhere. (p. 134, italics in original)

Moll and colleagues take the following perspective on learning: "learning does not take place just 'between the ears,' but is eminently a social process. Students' learning is bound within larger contextual, historical, political, and ideological frameworks that affect students' lives" (González, Moll, & Amanti, 2005b, p. ix).

Moll et al. (1992) offered an example of how a teacher's knowledge of household and community FoK can result in innovative teaching. During an interview, the anthropologist and a teacher noticed that Carlos, a young Mexican-American, sold Mexican candy to a neighbor. Another teacher interviewed a parent that was skilled in candy making. Subsequently, the teacher developed a multidisciplinary unit around this community FoK that included this parent coming to school to teach Mexican candy making. The multidisciplinary lesson on candy lasted a week and included math, science, health, consumer education, cross-cultural practices, and food production (Moll et al., 1992).

Funds of knowledge (FoK) in science education. Moje, Ciechanowski, Kramer, Ellis, Carrillo and Collazo (2004) presented an ethnographic study of a predominantly Latino/a community in Detroit. Their primary participants were 30 middle school-aged students from a two-way bilingual (Spanish/English) emersion school. Moje et al. (2004) also conducted an ethnographic study of the students' community. They investigated how *third space* can be built through science literacy and content learning. They also identified these students' FoK as "[i]t is also important to examine ways that these funds, or networks and relationships shape ways of knowing, reading, writing and talking-what Gee (1996) called Discourses–that youth used or tried to use to learn in secondary schools" (Moje et al., 2004, p. 38).

Moje et al.'s (2004) work is framed by hybridity theory. Third space results when a person's knowledges and Discourses from the "first" space of home community and peer networks merge with the knowledges and discourses of their more formal "second" space of church, work or school. The third space forms "a different, or alternative, space of knowledges and Discourses" (Moje et al., 2004, p. 41). The integration of multiple FoK and Discourses "is important to support youth in learning how to navigate the texts and literary practices necessary for survival in secondary schools" (Moje et al., 2004, p. 41).

Moje et al. (2004) identified the knowledges and Discourses available to students while they attempted to acquire science content literacy. They identified two broad categories; school funds of knowledge and Discourse, and everyday funds of knowledge and Discourse. Further, they subdivided everyday funds of knowledge and Discourses into the subcategories of family, community, peer group and popular culture.

Moje et al. (2004) found that family or home based funds typically centered on the students' parents' work in and out of home. Students also had knowledge related to family travel and family health issues. Moje et al. (2004) argued that the "dominant fund of knowledge offered by the community was one of a strong ethnic identity, a commitment to helping youth achieve educational and economic success, and a commitment to social and community activism" (p. 55). Peer FoK and Discourse, included ways in which peers help one another to "do" school, and to help one another read and write school texts (Moje et al., 2004).

Moje et al. (2004) felt the most important FoK and Discourse that they identified was popular culture. The majority of the time that they spent with students, the students were "engaging with and talking, reading, and writing about various forms of popular culture" (Moje et al., 2004, p. 60). The popular cultural practices used by these students "require[d] literate and discourse skills that could be mobilized as bridges to conventional content literacy learning, as navigational tools for examining different discourse communities and learning different skills, and as tools for challenging and reshaping representations of the world and of science and in popular culture" (Moje et al., 2004, p. 61). Further, these identified practices "may provide opportunities to demonstrate how people negotiate different discourse communities and, possibly, how people might challenge conventional scientific concepts that might be proven irrelevant or inaccurate when framed in everyday, experiential knowledge", p.60).

Moje et al. (2004) questioned why the students did not spontaneously bring everyday knowledge to bear on academic texts explicitly or publicly when they were asked to read and write in school. Although the youth strategically navigated across Discourse communities to make third spaces at school, they did not employ their everyday texts, knowledges, or Discourses to do the same in official classroom texts (Moje et al., 2004). Moje et al. (2004) speculate that "[p]erhaps this is because they subscribe to the binary between academic and everyday, or perhaps because they haven't had the opportunity to engage in analyses of how and why different communities develop conventions about knowledges and Discourse" (p. 66).

Basu and Calabrese Barton (2007) presented case studies of three urban high poverty middle school students that explored how these students' FoK helped them develop a sustained interest in science. The authors conducted their ethnographic study in an afterschool program. This afterschool science program was designed for high achievers, and in this school high achievers were students who scored on grade level in reading and math. Basu and Calabrese Barton (2007) expand the conceptual FoK framework as presented by González and Moll: "[the] funds of knowledge [framework] is based on one simple premise . . . that people are competent and have knowledge, and their life experiences have given them that knowledge" (González & Moll, 2002, as cited in Basu & Calabrese Barton, 2007, pp. 467–468). Basu and Calabrese Barton (2007) state that while Gonzales and Moll (2002) reference the historical and cultural knowledge of a community, Basu and Calabrese Barton (2007) also reference the knowledge that may be more specific to a family within a community. Thus, a young person may have knowledge of plants and animals as a result of living in a farming community. However, that same youth might have specific knowledge about elder care from growing up in a particular multigenerational household within that community. Furthermore, Basu and Calabrese Barton (2007) argue that a person's FoK may not only be revealed in what a person knows; but by his/her actions as well. "In other words," Basu and Calabrese Barton (2007) argue "one's disposition toward being a particular way in a given situation can be an outgrowth of what one has learned to value in a situation" (p. 468).

Furthermore,

> González and Moll (2002) argue that funds of knowledge are rooted in *practice* – in what individuals and communities do and what they think about what they do. Funds of knowledge therefore include knowledge, action, and disposition or habitus with recognition of how each of these domains are culturally constructed and refined. (Basu & Calabrese Barton, 2007, p. 468)

Most previous studies of the incorporation of FoK into science learning focused on learning in the short term, such as a curriculum unit or module. However, Basu and Calabrese Barton (2007) were interested in how a student's sustained interest in science was supported. The authors believed that youth exhibited a sustained interest (or disposition towards) science if "they pursued self-motivated science explorations outside the context of the classroom or used science in an ongoing way to improve, expand or enhance an exploration or activity to which they are already committed" (Basu & Calabrese Barton, 2007, p. 469).

As they developed their case studies, Basu and Calabrese Barton (2007) identified three themes. The first theme was the strong connection between a student's sustained interest in science and whether the student believed that science learning provided them with the skills they felt necessary to advance them toward their visions of their future. Basu and Calabrese Barton (2007) argue that the students' visions for their futures fall within the youths' FoK as their visions revealed beliefs that the students had about their own interests. In addition, their visions of the future gave the students goals that necessitated their strategic building of skills and knowledge. Basu and Calabrese Barton (2007) summarized this theme:

> The youth in this study had strong conceptions of the career and lifestyles they wanted to pursue. When science assisted them in moving toward their individual goals, they expressed an ongoing interest in learning and exploring their world through science. (p. 482)

A second theme that emerged was that students sustained their science interest in science learning environments if they were allowed to cultivate social relationships that mirrored their own values concerning relationships and communities (Basu & Calabrese Barton, 2007). The building relationships theme falls within the category of FoK because the particular way that students form relationships reflects not only students' beliefs, but also their strategic use of these dispositions within social environments. The students valued science if it allowed them to develop and maintain friendships while working in groups (Basu & Calabrese Barton, 2007).

The third theme that emerged was the primacy that students gave to their beliefs about what science is, how it should be used, and how it should connect to their lives (Basu & Calabrese Barton, 2007). Thus, “[a]gency and usefulness are centrally connected to how students activate their funds of knowledge in a sustained interest in science” Basu & Calabrese Barton, 2007, p.485). FoK are practices, and therefore, as well as being the cultural knowledges of an individual, FoK also explain how and why individuals act upon their knowledge (Basu & Calabrese Barton, 2007).

The authors concluded for the students in their study, the development of their sustained interest in science was fundamentally influenced by whether their FoK (their identity, beliefs, experiences, and conceptions of the future) were included within the science they studied. Also, “[w]hen students encountered science classrooms in which they could choose and engage in activities connected to their visions of the future, how they valued relationships, and their definitions of science, they developed a strong, long-term commitment to pursuing science (Basu & Calabrese Barton, 2007, p. 487).

Calabrese Barton and Tan (2009) conducted a six-week design experiment in a sixth grade science class in a low-income urban school. The researchers were interested in what FoK these students brought to their sixth grade science class and how the students used their FoK to support deeper engagement in science. The researchers also wanted to know how the incorporation of student FoK impacted /transformed the discourse and engagement of this science learning community. Calabrese Barton and Tan (2009) looked for FoK that these students presented within their classrooms that were accepted as forms of LPP. Because of previous work within the school, the authors were particularly interested in the food and nutrition unit taught in sixth grade science classes. They thought that the students found this unit compelling. Therefore, they worked with the sixth grade teacher and four students from the class to develop unit lessons that explicitly utilized FoK from the previous year's class.

Calabrese Barton and Tan (2009) adapted and expanded Moje et al.'s (2004) typology of student FoK and Discourses. They presented the following categories of FoK and Discourses: family, community, peer and popular cultural funds and Discourses.

The family funds that students specifically drew from during their unit on food and nutrition revolved around "family life involving food such as birthday celebrations, everyday nutritional habits and specific roles students play in their family related to food preparation" (Calabrese Barton & Tan, 2009, p. 57). Within this category, the authors noted four Discourse threads: family and ethnic traditions in food; cooking and diet; matriarchal leadership; shared child-raising and materials from the home that are shared communally. Calabrese Barton and Tan (2009) learned that students drew from community FoK to assist in their participation in school science. They define community funds and Discourse as the "experiences, knowledge, and ways-of-being students possess from being members of various figured worlds that matter to them, such as being members in the neighborhood where they live, or members of the larger school community (Calabrese Barton & Tan, 2009, p. 59). The Discourse threads that Calabrese Barton and Tan (2009) discovered were: peer challenges, habits, priorities and fast food. They also reported that these students drew from peer funds of knowledge and discourse which they defined as "the experiences, knowledge and ways-of-being students possess that support them in 'helping each other do school' [Moje et al., 2004] in ways that value who youth are and what they have to offer" (Calabrese Barton & Tan, 2009, p. 62). The authors subcategorize peer FoK into the Discourse threads studenting, solidarity and talents.

Calabrese Barton and Tan (2009) also identified popular cultural FoK and Discourse. They found that these students were devoted to popular culture including music, magazines, TV, movies, and the Internet. As well as categorizing the students' FoK and Discourses, Calabrese Barton and Tan (2009) were interested in "how these funds mattered in their engagement and learning in their sixth grade science learning community" (p. 64). They drew on hybridity theory to argue the importance of incorporating students' non-traditional funds and Discourses to maximize the spatial boundaries of official school science Discourse. Working from this perspective, they ascertained two critical patterns of change in student participation during the food and nutrition unit. First, Calabrese Barton and Tan (2009) found that broadening this official school space to be more inclusive of what counted as legitimate in this classroom supported new ways of engagement with the subject matter. These new forms of LPP promoted not only inclusion, but academic achievement as well. During classes in which the teacher actively sanctioned students' non-traditional FoK and Discourses, the number of classroom speakers increased, and speakers made content-based comments more often as well. Secondly, Calabrese Barton and Tan (2009) found that the nature of LPP shifted in a manner they termed "learning to take a scientific stance" (p. 67). Students seemed to leverage these chances to talk/act scientifically in ways they saw as less risky to their social status in the classroom. The value of the teacher's inclusion of FoK and Discourses legitimized multiple ways of participating within their science learning community. Calabrese Barton and Tan (2009) state that:

> Invoking these funds and Discourses allowed the students to author new hybrid spaces that supported their out of-school experiences with in school expectations. [W]e found that such acts of authoring helped to shift both the breadth and depth of student participation. (p. 68)

Lumbee Community and Home Practices that Might Provide Funds of Knowledge (FoK)

The Lumbee Indians retain their American Indian identity. Although they have adopted a Western lifestyle, they have a distinct folklore and folk traditions. One folk tradition that ties the Lumbee to other American Indians is the use of herbal remedies to treat illness (Croom, 1997). Like other American Indian groups in the United States, the Lumbee combine herbal remedies and the conjurer's magical treatment of disease into a medical system. Despite the fact that most Lumbee consult physicians and use modern medicine, many also use herbal remedies to treat and prevent illness and disease (Croom, 1997). The majority of Lumbee live in rural areas that give them access to a variety of plant communities. Plants are also easily found along roadsides, in ditches, and at the edge of forests. Due to the drainage practices of the 20th century, much former swampland is now cultivated. Drainage of the swamps has dramatically reduced the variety of plants that can be readily collected (Croom, 1997). Lumbee herbal medicine might serve as a FoK. I would suspect that Lumbee youth associated with persons who practice Lumbee medicine might have a more complete knowledge of plants than other youth (Bell et al., 2009). Indeed, during a 2012 HRE, I heard a discussion between a White female and a Lumbee female in response to being shown a sassafras plant during a night elective. The Lumbee female informed her colleagues that her grandfather often made sassafras tea for her when she did not feel well. Sassafras is one of the plants most used by the Lumbee for medicinal purposes (Croom, 1997).

The drainage ditches that I mentioned above may also serve as a possible source of FoK concerning reptiles and amphibians for Lumbee youths who attend HREs. One Lumbee applicant for the 2012 HREs noted that these “Robeson County Drainage Canals” crisscrossed her family property and she cited them as a possible place to continue her study of herpetology after the end of the HRE.

Lumbee Indians view Robeson County as the cultural heartland of their tribe; they have a reverence for the land on which they live (Dial & Eliades, 1996; Dial, 1993). They rarely sell their land. If land is sold, it is usually to family, almost never to non-Indians (Chavis, 1998). I believe this love of the land may also serve as a possible source of FoK for the Lumbee participants. A Lumbee youth who attended a 2012 HRE stated on his application essay that his family owned 350 acres with three small ponds. He stated that the land and the ponds would serve as future sites of herpetological study. The Lumbee Indians also revere the Lumber River (or the Lumbee River as it is known by the Lumbee) (Dial & Eliades, 1996; Dial, 1993). Several Lumbee youths stated that they lived near the Lumber River and it would serve as a place where they could monitor herpetological habitats.

There is a strong tradition of hunting and fishing among the Lumbee. Tradition relates that Henry Berry Lowry's father hunted with his White neighbors (Dial & Eliades, 1996). Marks (1991) discussed the long tradition of Whites, Blacks, and Lumbee hunting in Scotland County, one of the counties inhabited by Lumbees. He also reported that some Lumbees bred dogs for hunting. Chavis (1998) relates trips by Lumbee to the Atlantic Ocean for the purpose of fishing for spot. He asserts that the tradition is long standing; the earliest reported trips were in wagons pulled by mules. Several of the Lumbee youths discussed hunting and fishing trips prominently during the 2012 HRE. One conversation included the mention of an annual trip to Holden Beach for spot fishing.

In an earlier pilot study that preceded this dissertation, Ash et al. (2015) described the contributions that four Lumbee Indian male high school students made to the 2010 HRE. The hunting and fishing FoK of these Lumbee youths made them familiar with many of the outdoor scientific practices that the HRE employed. During the HRE, both hunting dogs and radio telemetry were used to locate Box Turtles as part of mark/recapture procedures designed to study box turtle populations and distributions. These Lumbee youths hunted with dogs, and they were experienced with radio telemetry. Hunters often fit their dogs with radio transmitters so they can keep track of the dogs' positions with radio receivers. Knowledge of these hunting practices allowed the Lumbee youths to quickly engage in the science being practiced by, and to make contributions to, this scientific community. The dogs' owner soon recognized that two of the Lumbee youths knew how to work with hunting dogs, and he relied on their help in keeping track of the dogs as they ranged widely searching for turtles. The scientist in charge of the Box Turtle studies quickly recognized two Lumbee youths' radio tracking skills. She and the Lumbee youths used radio telemetry equipment to track a turtle that had repeatedly avoided capture because it inhabited an almost impenetrable area. Thus, practices that were part of their fishing and hunting FoK but were similar to the HREs practices allowed the Lumbee youths to quickly engage in the science being practiced during the HRE. These similar practices allowed these Lumbee youths to quickly ally themselves with the summer science program, to assume central roles and to make early and significant contributions to the program (Ash et al., 2015).

Place-based Education and Informal Environmental Education with Reference to the Lumbee Sense of Place

As just discussed, the Lumbee have a strong connection to place. Broadly defined, place-based education focuses teaching and learning within a locale to merge community and environmental issues to improve education (Smith, 2013). Certain aspects of place influence learning processes and learning outcomes, according to sociocultural theorists (Bell et al., 2009). Influential aspects of place are physical features, available materials and the typical activities connected to that place. With its place-specific features and processes, the natural world focuses environmental inquiry and learning, and in environmental education, the natural environment can function as an infrastructure and focus for learning (Bell et al., 2009). Informal education occurring in the natural environment may be especially important for youth from rural areas. Agricultural lifestyles in rural settings place youth close to nature and can greatly enhance student understanding of and engagement with the flora and fauna of specific ecosystems (Bell et al., 2009).

The importance of place to the Lumbee people. In general, American Indians in North Carolina inhabit primarily rural areas, and this is specifically true of the Lumbee (Ross, 1999). My analysis of census data (United States Census Bureau, 2010) indicated that 79% of all Lumbee Indians in North Carolina lived in rural environments in southeastern North Carolina, with the remaining 21% living in urban areas. Whether they live in rural or urban areas, place is very important to the Lumbee (Lowery, 2009). They believe, as do the other state recognized tribes of eastern North Carolina, that they are the descendants of the original inhabitants of this area (Oakley, 2005). Oakley (2005) argued that their historical and present-day connection to this place is inexorably tied to their identity as American Indians.

One of the first questions asked by a Lumbee of a stranger is "Who are your people?" (Knick, 2008, p. 87). Another, early question is "Where do you stay at?" Lowery (n.d.) argued that the first question ("Who are your people?") helps the questioner to understand how the other person

> fits into the tribe's kinship system, an elaborate storehouse of genealogical information and values, behavioral expectations, and community responsibilities. Indian people place paramount importance on the group, not on the individual, so if one meets an individual for the first time, the most important thing to understand is how that person fits into the group. (para. 5)

The second question ("Where do you stay at?") has equal importance, as larger communities consist of smaller settlements and communities, each of which has its own unique history and cultural associations (Lowery, n.d.).

The Lumbee are one of many American Indian tribes that have state, but limited federal recognition (McCoy, 2003). Without federal recognition, the Lumbee Tribe does not have a federally protected land base, but the Lumbee still reside in their original homeland region (Blu, 1996; McCoy, 2003). The Lumbee homeland encompasses all Lumbee settlements and communities (Blu, 1996; McCoy, 2003); and the Lumber River that meanders near and through them. For as long as written historical documentation exists, the Lumbee have shared their home land with other races and ethnicities, but the Lumbee remain attached to this place (Blu, 1996; McCoy, 2003). For Lumbee Indians (and for other American Indian groups who live in the same area) Robeson County represents the heart of their homeland. Robeson County is also home for Lumbee who live in other places. There are Lumbee settlements as far away as Baltimore and Detroit, some of which were established as early as the 1930's (Dial, 1993; Dial & Eliades, 1996). Malinda Maynor Lowery, a Lumbee scholar wrote, "I was born in Robeson County, North Carolina, a place that Lumbees refer to as 'the Holy Land,' 'God's Country,' or, mostly, 'home,' regardless of where they actually reside" (Lowery, 2009, p. 499). Blu (1996) argued that for Lumbee Indians, their Robeson County home

> is a place where personal knowledge and personal connections count for a lot, where the climate is damp from the swamps and the sky is the dominant feature of the flat land, and where food tastes "right," better than it does in any other place. (p. 220)

Blu (1996) contended that for Lumbees (and other American Indian tribes), having a particular home place in the United States is essential for making them a particular people, and is thus fundamental for establishing their identity as a "nation," "tribe," or "group" (Blu, 1996, p. 223). Finally, Blu (1996) argued that "[f]or Lumbees and other Native Americans, the attachment to a particular place or set of places is necessary, not optional, for their group identity. It defines them as a particular people" (p. 224). For the Lumbee, that place is their ancestral homeland as symbolized by Robeson County.

Lumbee English as an aspect of Lumbee ties to place. The Lumbee Indians have a unique English dialect that is distinctive from those of Whites and African Americans who live in the same area (Torbert, 2001). When, in the early eighteenth century, Europeans arrived in the Lumbee homeland, Lumbee ancestors already spoke English, and dressed and farmed in a European manner. Their long-term use of English, and related loss of a native language, has been a persistent barricade to their full recognition as American Indians by the Federal Government (Torbert, 2001). While they cannot point to an ancestral Native American dialect, their particular dialect of American English unites them as a culture in the same way (Hutcheson, as cited in Torbert, 2001).

The Lumbee dialect differs from the variety of English spoken by their southern White and African American neighbors in grammatical construction, phonology (pronunciation) and lexicon (vocabulary) (Wolfram, 2000; Wolfram & Dannnenberg, 1999). According to Wolfram and Sellers (1999), the Lumbee English use of the *finite be* is an "ethnolinguistic marker" because the Lumbee are the only group that use it. Scott (2008) provides an example of this grammatical construction, "She bes justa singin' in the d'bacca field" (p. 74). Another grammatical construction unique to Lumbee English is the perfective *I'm* (Wolfram, 1996). Scott (2008) provides an example, "I'm done w'dis mess" (p. 74). A final construction unique to the Lumbee is the use of "It weren't me" instead of "It wasn't me" (Dannenberg, Locklear, Schilling-Estes, & Wolfram, 1996). The backed/raised diphthong phonologically distinguishes Lumbee English (Wolfram & Dannenberg, 1999). Lumbee elders change the sound of the *i* vowel to an *oy* sound, so a word like *high* would sound more like *hoy* (Dannenberg et al., 1996). Perhaps the greatest difference between Lumbee English and other local dialects is vocabulary (Dannenberg et al., 1996). Some examples of unusual Lumbee vocabulary words and terms follow: *ellick* – coffee, *Lum* – a Lumbee person, *yerker* – a mischevious child, *on the swamp* – neighborhood. A Lumbee term shared with the African Americans of southeastern North Carolina is *cooter* – a large swamp turtle (no particular species implied) (Dannenberg et al., 1996; Wolfram & Dannenberg, 1999).

The Herp Group (THG) as a Community of Practice (CoP)

The HRE that is the focus of this study evolved from a series of similar HREs that were held for four successive years (2007–2010) at Hickory Hills Camp and Retreat Center (HHC) in the rural piedmont of North Carolina. I speculated that THG was a scientific CoP that developed these continuing residential HREs to initiate high school students into their community's scientific herpetological field practices. Further, I have shown that Lumbee youths brought FoK that originated in their rural backgrounds that afforded their easy integration into, and unique contributions to, this scientific CoP (Ash et al., 2015). These HREs were designed to introduce participants to: native North

Carolina reptiles and amphibians, the practices of scientists engaged in herpetological fieldwork, and possible careers in ecology and herpetology. The original HRE instructors included three university faculty members in science and science education, environmental education center staff, and several special returning guests including professional herpetologists. During the course of these HREs, and also during pre-existing collaborations, these old-timers coalesced into a herpetological CoP that invited and welcomed newcomers (high school students) into its practices during its HREs.

Herpetological Research Experiences as Joint Enterprises

I believe that the HRE that is the focus of my study is one result of the joint enterprises of a scientific CoP. Since these enterprises centered on the practices of herpetology, I refer to this CoP as the Herp Group (THG). One aspect of THG's shared endeavors was the evolution of a herpetological research community that purposefully made its periphery permeable to newcomers (Wenger, 1998). Thus, each summer, THG connected to outside communities by offering high school newcomers various opportunities to participate in its practices. The possibilities for newcomer participation ranged from observation of, to actual engagement in, some of the community's shared repertoire (Wenger, 1998). THG's shared repertoires addressed environmental issues in general, and herpetological research issues in particular.

In another important endeavor, THG contributed to the scientific herpetological knowledge of the area surrounding HHC. Thus, since 2007, THG has maintained records of the species and numbers of amphibians and reptiles they encountered each year. Also during this time, THG has connected with associated scientific CoPs by documenting these encounters and uploading the information to the Carolina Herp Atlas (CHA) website. The CHA is a

> project developed by the Davidson College Herpetology Laboratory and Davidson College Information Technology Services. The primary objective of the CHA is to provide detailed data on the distribution of reptiles and amphibians of North and South Carolina. (Davidson College, 2006)

Additionally, THG forwards the information it collects about box turtles to The Box Turtle Connection (BTC). The BTC is a statewide initiative that encourages citizen scientists to collect information on the box turtle (UNC Greensboro, 2013). Ms. M, who is one of THG's core old-timers, is also a core member of the BTC.

The development of and ongoing collaboration of The Herp Group (THG). Historically, THG developed over several years as the result of collaborations and chance meetings of people who had differing expertise in herpetological field practices, but who shared a passion for making these practices accessible to high school students. Below, I provide a history of THG.

A description of the founding members of THG follows: Dr. A is a science/environmental education professor at a regional public university. Mr. R is a herpetologist who works in a state wildlife position and is a respected member of his state's herpetological society. Dr. W is a science/environmental education professor at a private university. Ms. M teaches biology at the same regional university as Dr. A. JR is a private citizen who makes a living, in part, through the scientific use of his trained dogs that can find and retrieve box turtles. JR and his dogs have contributed to the scientific study of terrestrial turtles throughout the United States.

Dr. A met Mr. R when she and the students in her environmental science education course attended Mr. R's outdoor environmental class about amphibians and reptiles. Three years later, Dr. A took her environmental science education students to Mr. R's outdoor herpetology class again. It was then that Dr. A introduced Dr. W to Mr. R. At this point in her career, Dr. W was pursuing her doctorate in environmental science education under the direction of Dr. A, and she was a member of this class. As part of the requirements for Dr. A's course, Dr. W collaborated with Dr. A and Mr. R to write an article about Mr. R's work. Subsequently, Dr. A and Dr. W began to conduct activities similar to Mr. R's at HHC. Mr. R was a frequent contributor to these activities designed to teach young people about reptiles and amphibians.

During approximately the same time period, Dr. A and Ms. M collaborated on a box turtle project for middle school students. When Ms. M related the difficulties of finding box turtles with middle school children to a university administrator, someone with a solution overheard her conversation. This person had a friend whose dogs retrieved box turtles. Dr. A, Ms. M, and RJ met and formed a collaboration that helped teach youth about box turtles. These separate collaborations, having Dr. A as a common element, merged and broadened their scope to encompass environmental science education with regard to both reptiles and amphibians. After receiving funding (a Burroughs Wellcome grant), Mr. R, Dr. A, Dr. W, Ms. M, and RJ collaborated on their first HRE in 2007 at HHC. During the third HRE, Dr. N, and I were invited to be newcomers and have been part of the group since. Although the original grant expired at the end of the 2010 HRE, many THG members participated in a special HRE in the summer of 2011. Ms. K, Dr. A's doctoral student, and a long time THG member, advanced to old-timer status as she, with Dr. A's help, directed an HRE at HHC for elementary school-aged participants. This HRE was the focus of Ms. K's dissertation. THG old-timers (Dr. W, RJ, and Mr. R) and relative newcomers (Dr. N and I) volunteered to help with this HRE for elementary students. Subsequently, Ms. K obtained her Ph. D., and she continues to teach her own science education students many of the herpetological and science education practices she learned as a member of THG.

Over the course of their association and continuing into their oversight of the first four HREs, and their involvement in Ms. K's HRE, THG became mutually engaged in developing a shared repertoire of distinct practices concerning: box turtle and aquatic turtle capture and marking, population estimation; snake capture, handling and identification; frog and toad recognition, capture and call recognition. In addition, they sought ways to integrate these practices with science education. This long-term association for common purposes or goals amounts to a de facto CoP.

THG old-timers developed these practices to support two intertwining joint enterprises. The first enterprise involved using herpetological field practices to collect scientific information about the amphibian and reptile populations at HCC. The second enterprise purposefully allowed high school newcomers peripherality (Wenger, 1998) with respect to THG's scientific practices during summer HREs.

Continuing the THG tradition, Dr. W developed a summer herpetology course. Her herpetology course was part of a four-week long academic enrichment experience for under-represented youth. Titled the Summer Scholar's Academy (SSA), Dr. W's university sponsored this enrichment program. Several members of THG were involved in Dr. W’s summer herpetology course. Mr. R, as he had done at every HRE, traveled from his home in a different part of the state to make a presentation to the students about herpetology, and in addition, he accompanied SSA students to HHC where they captured and marked aquatic turtles. RJ brought his dogs to help the SSA students find and mark box turtles. Dr. A hosted SSA students at her ephemeral pool, where they studied spotted salamanders and red spotted newts.

In 2011, the National Science Foundation (NSF) awarded a four-year grant to THE; this grant has allowed the continued offering of HREs on an annual basis.

Indicators that The Herp Group (THG) functioned as a community of practice (CoP). Wenger (1998) presented 14 indicators that mutual engagement; joint enterprise and shared repertoire are present within a CoP. Researchers have used these indicators to describe both what a CoP should look like, and to analyze whether a CoP is present (Boud & Middleton, 2003; Holmes & Meyerhoff, 1999; Nickols, 2012). Many more recent authors have developed enhanced or alternative lists of indicators that have been merged into a master list (Winton & Ferris, 2008); I have chosen to use Wenger’s (1998) original list in order to evaluate the CoP discussed here. While I will use these indicators to support my contention that THG is a CoP, it is important to understand that a given CoP will exhibit some or all of these indicators, and to varying degrees. In other words, it is not necessary to demonstrate all fourteen indicators in order to demonstrate a CoP (Holmes & Meyerhoff, 1999). A summary of these indicators as they apply to THG is presented in Table 1.

Table 1

Evidence that THG functioned as CoP

Wenger's Indicators of CoP	CoP Dimension	Evidences of Indicators Exhibited by THG
Sustained mutual relationships – harmonious or conflictual.	Mutual engagement	Core old-timers provided the same program for four consecutive years, each member was consistently responsible for specific tasks. New comers were given tasks consistent with, and complimentary to, those of old-timers. Relationships were not always harmonious: graduate students would complain.
Shared ways of engaging in doing things together.	Mutual engagement Joint enterprise	Throughout the years, THG old-timers worked together to develop agreed-upon routines and methods for setting up and administering the HRE. Old-timers developed the appropriate herpetological protocols used to gather, interpret and report field data.
The rapid flow of information and propagation of innovation.	Mutual engagement	During the HRE, daily organizational/administrative meetings occurred at an old-timer's home. Newcomers and old-timers alike were included in these meetings. When HREs were not in session, electronic communication was used to efficiently determine individual responsibilities, acceptance of participants, and other critical HRE activities.
Absence of introductory preambles, as if conversations and interactions were merely the continuation of an ongoing process.	Mutual engagement Shared repertoire	THG's old-timers were friends. Some associations preceded the HREs, and all will continue afterwards. Meetings of old-timers exhibited none of the stilted protocols often associated with professional meetings.

Table 1

(Cont.)

Wenger's Indicators of CoP	CoP Dimension	Evidences of Indicators Exhibited by THG
		Decisions were often made in a living room over assorted beverages. When HREs were in progress, THG old-timers requested only scheduling information, and independently performed their tasks with no further discussion necessary.
Very quick setup of a problem to be discussed.	Mutual engagement Shared repertoire	While HREs were in session, THG old-timers needed no direction, only scheduling information. HRE problems were solved quickly and informally at daily meetings.
Substantial overlap in participants' descriptions of who belongs.	Mutual engagement	Without exception, and within seconds, all THG old-timers could name all other old-timers. Most old-timers could quickly identify newcomers.
Knowing what others know, what they can do, and how they can contribute to an enterprise.	Mutual engagement Joint enterprise Shared repertoire	If needed, and at a moment's notice, any THG old-timer could step in and perform any HRE task if needed. All old-timers were cognizant of other's expertise, and all knew enough to make the HRE function smoothly and seamlessly.
Mutually defining identities.	Mutual engagement	The THG old-timers recognized each other as educators/advocates for the environment in general, and reptiles and amphibians in particular. During the HREs, an administrative structure was necessary and all understood their roles and that thisstructure was necessary for theHRE's success.
The ability to assess the appropriateness of actions and products.	Shared repertoire	Daily, during the HRE, and annually between HREs, THG old-timers reviewecd HRE activities and assessed learning by participants.

Table 1

(Cont.)

Wenger's Indicators of CoP	CoP Dimension	Evidences of Indicators Exhibited by THG
		Due to such assessments, HRE activities have been added, eliminated, modified or replaced. Participant learning was used to guide these decisions.
Specific tools, representations, and other artifacts.	Shared repertoire	Each HRE activity utilized a specific set of scientific tools (e.g., traps, scales, rulers, and calipers). Each activity had its own data collection protocols and reporting procedures. Participant learning was assessed by standardized test instruments and interview protocols approved by THG old-timers.
Local lore, shared stories, inside jokes, knowing laughter.	Shared repertoire	There were countless stories about who got bit, which old-timer/participant did what, how animals acted, how the HRE environment had changed for the better or worse, and about how some former participants had progressed to a fuller participation in science.
Jargon and shortcuts to communication as well as the ease of producing new ones.	Mutual engagement Shared repertoire	Some examples of jargon were: Herps for herpetofauna, HHC for Hickory Hills Camp, l, Abbie, the most frequently seen turtle, instead of her code: ABI.
Certain styles recognized as displaying membership.	Mutual engagement	Some indicators of THG membership were: readily identified field wear, backpacks, water bottles, understanding of field measurement gear and their use, wearing headlamps at night, having the appropriate field guide, specific knowledge of herp species, wearing rubber boots or waders for aquatic work.

Table 1

(Cont.)

Wenger's Indicators of CoP	CoP Dimension	Evidences of Indicators Exhibited by THG
A shared discourse that reflects a certain perspective on the world.	Mutual engagement	THG held several important group perspectives: that an understanding of the environment in general and of herpetological ecology in particular, make individuals better world citizens and that engaging in HRE practices make participants more environmentally aware and conscious of the need for herpetological conservation, that education is the key to the preservation of the natural world and the organisms that inhabit it.

Note. Evidences are interpreted in light of indicators produced by Wenger (1998) and subsequently linked to Wenger's three original defining dimensions of CoP coherence (Li et al., 2009).

I contend that as one aspect of its joint enterprises, THG structured its HREs as a way to open its practice to offer membership to newcomers through both peripherality and legitimacy (Wenger, 1998); both being required for LPP. To provide peripherality during the HREs, THG purposefully created permeability, which allowed high school students to engage in herpetological field science and its practices. According to Wenger (1998):

> Peripherality provides an approximation of full participation that gives exposure to actual practice. It can be achieved in various ways, including lessened intensity, lessened risk, special assistance . . . It can involve explanations and stories, but there is a big difference between a lesson that is *about* the practice but takes place outside of it, and explanations and stories that are *part of* the practice and take place within it. (p. 100)

Regardless of how it opens its periphery for initial participation, the CoP must not only engage newcomers but also allow newcomers to understand how the CoP operates. The CoP must allow newcomers opportunities to mutually engage with other community members, to witness/engage in the CoP's negotiation of its joint enterprise, and to allow newcomers to use the CoP's shared repertoire (Wenger, 1998). In addition to peripherality, newcomers must be legitimately viewed by old-timers as potential members. Granting newcomers legitimacy is important because newcomers' engagement within a CoP may fall short of the community's view of competence. Legitimacy allows a newcomer's "inevitable stumbling and violations" to become "opportunities for learning rather than cause for dismissal, neglect or exclusion" (Wenger, 1998, p.101).

The THG granted both legitimacy and peripherality to the HRE participants. Participants were admitted after a screening process. They were allowed to participate with lessened intensity and risk, and with special assistance when necessary. Participants were always under the oversight of old-timers, but were given the opportunity to feel useful and of worth to THG. Mistakes were tolerated and treated as learning opportunities rather than reasons for exclusion or dismissal. The participants were mutually engaged within THG, both socially and within the joint enterprise. During the week, all participants became familiar with THG's shared repertoire as they were exposed to THG's practices for acquiring and recording data concerning reptiles and amphibians. Throughout the week, they learned how to use THG's tools and artifacts to collect amphibians and reptiles; measure, mass and mark them; enter data concerning these animals; and methods for presenting data for public consumption. In addition, they learned THG's field techniques and protocols for recording data; they defined the meanings of these processes as a group. After being introduced to the specific sub-practices for each research protocol, the students negotiated in which practice they would specialize.

THG had an indigenous nature; the knowledge and practices developed were in response to the greater body of knowledge being studied, but were practiced within and adapted to the constraints of the environment (Wenger, 1998). All the community's practices revolved around the HRE, and the participants used the tools and artifacts found at hand. As they engaged in research team tasks such as data acquisition and correct data entry, they developed mutual accountability.

To summarize, I conceived that THG could be modeled as a CoP that purposefully structured its HREs to allow newcomers legitimacy and peripherality. I believed that the Lumbee youths brought FoK that allowed them to incorporate into the community quickly and to have enhanced trajectories as contributors to this CoP. This process has been documented for an earlier version of these HREs (Ash et al., 2015).

Conclusion

In this literature review, I have discussed the concepts of CoP and FoK: their origins, historical evolution, and applicability to and usage in the field of science education. Further, I have extended the concept of FoK to the Lumbee homeland and have suggested possible sources of FoK derived from place, community and family. I discussed Lumbee English as an aspect of Lumbee ties to place. Finally, I presented evidence that supports my contention that THG is a CoP that opens its periphery to high school newcomers and grants them LPP in the study of herpetology and herpetological field practices.

CHAPTER III

A SHORT SOCIAL, POLITICAL, ECONOMIC, AND EDUCATIONAL HISTORY OF THE LUMBEE TRIBE

Moll et al. (1992) “use[d] the term ‘funds of knowledge’ to refer to historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well being” (p. 133). If we accept this premise, then it is necessary for the purposes of this dissertation to document the social, political and economic history of the Lumbee Tribe. Because FoK are accumulated and culturally developed, I feel it is important that the reader has a detailed understanding of the history of the Lumbee people. The history of the Lumbee over the last 300 years has defined them as a unique American Indian community. An understanding of their interactions with other groups is imperative when interpreting the behaviors and actions of the Lumbee participants discussed in this dissertation.

Indian Appellation

As I stated in Chapter I, “What we call, or who and how we term Indigenous Peoples of the United States is important, especially to these Indigenous People.” Here, I present the literature review, which led me to conclude that I would preferentially refer to the Lumbee Indians of North Carolina as *American Indians,* except in cases where I may use *American Indian*, *Indian* and *Native American* interchangeably to avoid repetitious text. I turned to the work of three scholars in order to properly reference the Indigenous Peoples of North Carolina including the Lumbee (Harrington, 2012; Lowery, 2010;

Oakley, 2005). Lowery (2010) states that she is often asked whether *Indian* or *Native American* is the more correct term for the Indigenous Peoples of North America. Lowery (2010) feels that the way to determine the appropriate terms is to use the term that the particular group uses to describe themselves while remaining cognizant of the context or audience that they are addressing. She uses the term *Indian* and *Native American* interchangeably. Lowery (2010) grew up calling herself an *Indian*, but she has come to appreciate that the term *Native American* acknowledges a group's status as the original inhabitants of a place. She also contends that most *Indians* of her acquaintance within the United States use the term *Indian* when conversing with one-another. However, these same individuals will use the terms *Native American* or *Indigenous* when addressing multi-tribal, multiethnic or international audiences, or when discussing tribes or native nations in general. She also uses the term *People* as she discusses Indians, as Indians often use this term to talk about members of their own group. Lowery (2010) believes that using the term *People* acknowledges that Indians have a history and a sense of self that predates the colonial relationships that labeled them *Indians, Native Americans* or *Indigenous.*

In recognition of the Lumbee Tribe's history and historical changes in the Tribe's name, Lowery (2010) uses the contemporaneous tribal name for this tribe. Thus, when describing a time when they were known as The Croatan Indians of Robeson County, she refers to them as *Croatans* or *Croatan Indians*. Similarly, she refers to them as *Cherokee Indians* when they were known as the Cherokee Indians of Robeson County.

Oakley (2005) tries to be as specific as possible when referencing American Indians. He feels that it is best to refer to an individual using their tribal name such as *Lumbee* or *Haliwa-Saponi* rather than simply *Indian*. However, he concedes that some general statements are necessary, thus he uses the terms *Native American*, *American Indian* and *Indian* interchangeably in some cases. However, he believes that *American Indian* is the term currently favored by American Indians. He argues that the use of the term Native American may be confusing as it defines anyone in the United States (Oakley, 2005).

Herrington (2012), a Lumbee Indian, states that Lumbee tribal elders refer to themselves as *Indian*, and contends that the term *Indian* is the term most commonly used by Lumbees. In agreement with Oakley (2005), Harrington prefers *American Indian* to *Native American*. Additionally, Harrington (2012) emphasizes the importance of using specific tribal names when applicable. Some American Indians often include their specific tribal affiliation (Lumbee, Waccamaw, Waccamaw-Siouan, and Tuscarora) after their names (Harrington, 2012). Both Harrington (2012) and Oakley (2005) agree that the use of *Indian* alone is confusing because the term also refers to people from the Indian subcontinent. Here, I will refer to these indigenous precursors of modern Lumbee as *Lumbee Ancestors* when discussing a time in their history when they did not have a recognized tribal name (state or federal).

The Lumbee People as Americans and Southerners

The history of the Lumbee and the history of their schools are inseparable (Davis, 1986). In addition, when discussing the history of the Lumbee Tribe and their institutions, such as their schools and their churches, it is important to situate their history within the context of the history of the United States of America in general, and the southern United States in particular "for both these larger settings have an impact on the way Indians present themselves and on the way others respond to them" (Blu, 2001, p.4). Blu (2001) continues:

> As Southerners, the Lumbee have participated in the great events of Southern history from the Revolutionary War, when a few Indian men fought beside Whites for independence, to the Civil War and Reconstruction, during which the guerrilla band led by a young Henry Berry Lowery held local Whites at bay for several years. The Indians share with Whites and Blacks the memory of ancestors' stories about these events, if not the same interpretations of them. But of all the aspects of Southern experience, the most pervasive is the system of racial classification and the institutionalized segregation of races based on it. It is within this system that the Lumbee have had to work to establish their identity. (Blu, 2001, p. 5)

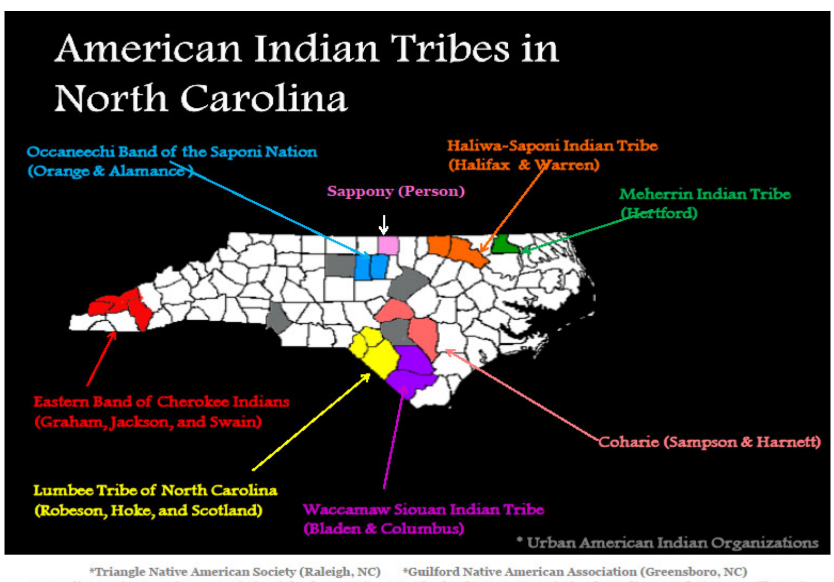
An Introduction to the Lumbee Tribe of Eastern North Carolina

Lumbee Indians differ from other Native American groups in numerous ways. One major difference is that they do not have a native language other than English, which they have spoken since the eighteenth century. Lumbee Indians have never lived on a reservation, and have never been wards of state or federal governments as have other Indian tribes. The Lumbee have different religious (most are Southern Baptists) and social practices, customs and beliefs than other, federally recognized Indian tribes (Bryant & LaFromboise, 2005).

The Indian tribes that originally occupied the area now known as the State of North Carolina included the following: Chowanoke, Hatteras, Moratoc, Secotan, Weapemeoc, Machapunga, Pamlico, Coree, Neusiok, Tuscarora, Meherrin, Cherokee, Cape Fear, Catawba, Shakori, Sissipahaw, Sugeree, Waccamaw Waxhaw, Woccon, Cheraw, Eno, Keyauwee, Occaneechi, Saponi and Tutelo (North Carolina Commission of Indian Affairs, 2008). As European settlements spread across the North Carolina Piedmont, small tribes sought to escape this encroachment, and by the 1800s, had joined together in eastern and southern North Carolina, southern Virginia or South Carolina. These groups coalesced into the present day state-recognized tribes of North Carolina: Coharie, Eastern Band of the Cherokee Indians, Haliwa-Saponi, Lumbee, Meherrin, Occaneechi Band of the Saponi Nation, Sappony and Waccamaw Siouan (North Carolina Commission of Indian Affairs, 2008).

The Native American population in North Carolina (estimated in excess of 100,000 in 2005), is larger than that of any other state in the South, and is also one of the largest in the United States (Oakley, 2005). Of this number, approximately 10,000 are members of the Eastern Band of the Cherokee who reside on the Qualla reservation in western North Carolina (Oakley, 2005). The other 90,000 American Indians in North Carolina live in rural areas dispersed across the landscape in two general areas: an area along the northeastern and north central portions of North Carolina's border with Virginia, and a cluster of several counties in the southeastern Coastal Plain (Oakley, 2005; see Figure 1).

Lumbee Indian origins are disputed by scholars (Blu, 2001; Davis, 1986; Dial & Eliades, 1996; Perdue, 1985; Sider, 2003), and "are probably the most discussed aspect of the group, but despite an enormous volume of writings, most of it remains speculative" (Blu, 2001, p. 36). The Lumbee Indians may be descendants of different coastal Indian peoples who coalesced in the region of Drowning Creek (Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003). The Lumber River was called Drowning Creek until the name was changed by state legislation in 1809 (Ross, 1999). Some American Indian people came to this area after wars and diseases precipitated by the onslaught of European immigrants decimated their original tribes (Bailey, 2008; Blu, 2001; Dial & Eliades, 1996; Knick, 2000; Lumbee Tribe of North Carolina, 2013a; Maynor, 2005; Sider, 2003). Due to differing tribal languages, customs, and practices, and the close proximity of Whites, these Indian peoples probably adopted English and many of the European manners of living (Blu, 2001; Dial & Eliades, 1996; Dial, 1993; Perdue, 1985). Managing to survive in an isolated, swampy, and (at that time) undesirable area, the Lumbee developed into a unique American Indian community that is based on kinship bonds (Bailey, 2008; Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003).



Source: UNC School of Education (n.d.)

Figure 1. Locations of Principal Native American Tribes in North Carolina.

Many scholars (Blu, 2001; Dial & Eliades, 1996; Perdue, 1985; Sider, 2003) agree that, when first encountered by Scottish immigrants in the mid-1730s, the ancestors of the Lumbee Indians lived along the Lumber [Lumbee] River in log cabins or simple houses and spoke English. Additionally, the ancestors of the Lumbee had many European practices, including farming methods (Dial & Eliades, 1996; Perdue 1985). Although the Lumbee's ancestors and these European immigrants shared similar practices and culture, these European immigrants and their descendants recognized the Lumbees' ancestors as a distinct ethnic group, but not always as Native American (Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003).

Since the mid-1700s, this ethnic group has struggled to be recognized as American Indian and has been known by a succession of labels. Outsiders often applied derogatory labels to the Lumbee's ancestors who sought to establish their American Indian identity (Peck, 1972), and began to seek their own labels during the late 1800s. This list of labels includes (in rough chronological order) many labels applied to them by others: "a mixt Crew, a lawless People," "a number of free Negroes and mulattos who infest that County," "all other free persons," "free persons of color," "Scufflletownians," and mulattos. Lumbee ancestors have also applied a succession of labels to themselves: Croatan Indians of Robeson County (1885), Indians of Robeson County (1911), Cherokee Indians of Robeson County (1913), Cheraw Indians (1933), Siouan Indians of Lumber River (after 1993) (Blu, 2001; Dial & Eliades, 1996; Maynor, 2005; Sider, 2003).

Finally, in 1953, the North Carolina state legislature enacted legislation that recognized these people of Indian descent as a tribe: The Lumbee Indians of North Carolina (Blu, 2001; Dial & Eliades, 1996; Lumbee Tribe of North Carolina, 2013a; Maynor, 2005; Sider, 2003). Dial (1993) argues that the "Lumbee's greatest victory in their fight for recognition occurred in 1956, when an act of the U.S. Congress confirmed that the Lumbee were in fact Indians" (p. 23). The congressional act that gave federal recognition to the Lumbee Indians was entitled An Act Related to the Lumbee Indians of North Carolina. However, the U.S. Department of the Interior interceded before the law was enacted and succeeded in having the following language inserted into the law:

> Nothing in this Act shall make such Indians eligible for any services performed by the United States for Indians because of their status as Indians and none of the statutes of the United States which affect the Indians because of their status as Indians shall be applicable to the Lumbee Indians. (An Act Related to the Lumbee Indians of North Carolina as cited in Wilkins, 1998, p. 159)

Therefore, this act gave the Lumbee Tribe recognition in certain aspects, but not the complete recognition provided to tribes on reservations. This limited recognition comes with limited monetary support compared with that provided by full recognition (Dial, 1993). Political efforts are continuing to pass federal legislation that will grant full federal recognition to the Lumbee Tribe of North Carolina (Lumbee Tribe of North Carolina, 2013b).

Competing Theories of Lumbee Ancestral Origins

I relied on Blu's (2001) discussion of Lumbee origins in composing this aspect of Lumbee history. Blu mentions several existing and competing theories that explain

Lumbee origins: Descent from American Indians who interbred with members of Sir Walter Raleigh's Lost Colony at Roanoke Island (This theory is now a common Lumbee oral tradition), Descent from the Cherokee, Cheraw or Tuscarora, Descent from primitive American Indians indigenous to the Lumbee Tribe's current home in Robeson County, and Descent from survivors of many tribal groups existing in southeastern North Carolina that coalesced into a single group seeking shelter from disease, wars and White settlers moving into the region.

By the early 1700s, there had been massive dislocations of Indians to the north and south of Robeson County (Blu, 2001). The 1711 Tuscarora War possibly drove some Indians south to seek safe haven in the swampy areas between North and South Carolina. A smallpox epidemic raged in South Carolina during the 1730s. People fleeing this epidemic may have fled north, seeking refuge in the same swamps. Blu (2001) also speculates that Robeson County may have provided sanctuary for Indians, Whites, or Blacks who wanted to avoid a highly organized government. "The swamps of what was to be Robeson County combined with the County's uncertain colonial status attracted people of Indian descent with the promise of protection" (Blu, 2001, p. 43).

Colonial Robeson County

When Europeans first initiated settlements in Robeson County in the 1700s, they found Indians who already spoke English. The Indian groups who settled the County may have been bilingual in an Indian language and English (Blu, 2001). They may have spoken English because of intermarrying with Whites or because of contact with Whites before they fled to this region. If they were bilingual, then English would have served as a *lingua franca* for the differing groups (Blu, 2001).

Early Black Settlers

Most of the early Black settlers in Robeson County were slaves, although some were free. Slavery was practiced in this area, and Blacks came to Robeson County with the Whites who immigrated from Virginia and South Carolina (Thompson, 1973).

Indian and Black Relationships during Colonial Times

Dial (2005) argues that the same historical, social, and political factors that drove the Lumbee ancestors to seek refuge in the swamps of Robeson County bolstered an animosity between American Indians and African Americans. Whites helped foster division between Indian and Blacks in the 18th century colonial Southeast (Dial, 2005; Woods, 2001). Dial (2005) reports that some Indian tribes in the Southeast, such as the Catawba, were hostile against Blacks because of trade competition. However, colonial Whites found themselves in a precarious position as two exploited populations, Black slaves and Indian tribes challenged their supremacy. Fearing an alliance between Blacks and Indians, White colonists sought to separate these groups by prohibiting intermarriage and trade between them (Dial, 2005; Woods, 2001). By these measures, Whites sought to separate and alienate the Indians and Blacks, thereby maintaining control over both groups.

The Lumbee People during Colonial Times

Although in other North American colonies outside southeastern North Carolina, White relationships with American Indians

> generally constituted a sorry record of false promises, misuse, and the playing off of Indians against Indians, or, in some instances, the Indians against Blacks to prevent any kind of my minority alliance, Lumbee-white relations were generally serene. (Dial & Eliades, 1996, p. 29)

Dial and Eliades (1996) argue that the colonial definition of Indian was based on culture rather than race. In other words, an Indian was a person who lived an Indian way of life. After the Lumbee accepted the concept of private property, the most visible difference between the Lumbee and their new White neighbors was skin color. The two groups differed little in status or occupation, and their differences with their new neighbors were essentially economic (Dial & Eliades, 1996). The Lumbee ancestors had to protect the lands they claimed from the newcomers. However, the Lumbee competed as equals rather than "inferior savages" (Dial & Eliades, 1996, p. 30). Indeed, Lumbee ancestors learned to use the colonial judicial system in the competition. As long as cultural factors formed the basis of Lumbee-White relationships, the differences between the two groups were manageable. Indeed, the first federal Census of the United States was taken in 1790. This census recorded 85 Lumbee families living in Robeson County, and these families were listed under the classification of "all free persons not white" (Dial & Eliades, 1996).

The American Revolution and the Early 1800s

Several Lumbees served with American forces against the British during the American Revolution (Dial, 1993). Dial (1993) speculates that these Lumbee ancestors believed, as did White colonists, that they would have better lives in the independent state of North Carolina than in an English colony. The Lumbee probably benefited from the

Revolutionary War and the subsequent animosity between nationalist and loyalist Whites. For instance, the Lumbee ancestors who served with the rebellious American forces were rewarded with government pensions, land grants or other property, including Black slaves (Dial, 1993).

White fears of American Indians increased during the War of 1812. Indians of the Midwest and Southeast unified under the leadership of Tecumseh, a Shawnee chief. This Indian confederacy formed to resist continuing American expansion into their territories and sided with the British during the War of 1812. Tecumseh died during the Battle of the Thames in 1813, but White Americans continued to fear his vision of an organized Indian confederacy that would fight widespread settlement of Indian territories by Whites (Dial, 1993).

The fear of American Indian alliances against White aggression and the insatiable White American desire for land compelled Congress to pass the Indian Removal Act in 1830. This Act gave the President of the United States the right to negotiate with Eastern Indian tribes for their removal to areas west of the Mississippi (Dial, 1993). As they owned land as individuals, the Lumbee ancestors were considered nontribal, and they were not directly affected by the Indian Removal Act and were not forcibly removed as was the Cherokee Tribe of western North Carolina (Dial, 1993). During the early 1800s, the first Indian removals occurred as Southerners paid more attention to the politics of race and color. This attention was due in part to two much-publicized slave uprisings. Southern Whites tried to convince themselves that slavery was benign, and benefited both Whites and Blacks. These two rebellions revealed the weakness of the White arguments, and therefore fearful Southerners began to exert even more harsh control over the region's Blacks, both free and slave. Southerners produced legislation that prevented the free movement of Black slaves and free Blacks. During this time, free Blacks were deprived of the few civil rights they previously enjoyed (Dial, 1993).

From 1835 to 1885: The Half-century Dark Ages

In 1835, as a result of North Carolina state legislation, Lumbee Indians were disenfranchised as American citizens and lost their right to vote and other rights under the law. Thereafter, the social and economic standing of these American Indians decreased dramatically, preventing most Lumbee Indians from receiving even a rudimentary education. The effects of the American Civil War and the resulting Reconstruction only exacerbated the Lumbee's economic and social woes. The Lumbee refer to the period of disenfranchisement, the Civil War, and Reconstruction as "the Half-Century Dark Ages" and date these dark years from 1835 – 1885 (Thompson, 1973; Dial, 1993; Dial & Eliades, 1996). The Lumbee would begin to move "out of darkness" when the state of North Carolina recognized the Lumbee ancestors as American Indians and provided for the establishment of a separate American Indian school system.

From 1835 to the Start of the Civil War (1864)

In 1835, North Carolina called a special state Constitutional Convention (Dial, 1993). Among other issues, the Convention addressed the question of

> whether any, and if any, amendments are proper to be made to the said Constitution, as to the abrogation or restriction of the right of free Negroes or mulattoes to vote for members of the Senate or House of Commons. (Dial & Eliades, 1996, p. 40)

The delegates proposed disenfranchising free Blacks. The people of North Carolina ratified this and other proposals presented by the Constitutional Convention. In 1840, the state of North Carolina denied free Blacks the right to bear arms without a license or to serve in the militia (Dial, 1993; Dial & Eliades, 1996).

The Lumbee ancestors failed to recognize that the White view of their American Indian neighbors was evolving (Dial, 1993). Before this era, Whites used behavior to categorize Indians. To Whites, an Indian was a person who acted like an Indian or who exhibited behavior typified as Indian or “savage.” Indian removal policy required justification for relocating some tribes west of the Mississippi. At this point, Whites wanted tribal lands, and therefore Whites sought ways to rationalize the removal of these tribes from their land (Dial, 1993). Whites now thought of American Indians in a racial way associated with a people’s skin color, rather than their specific behaviors or lifestyle. Consequently, Whites viewed Indians, regardless of their life ways, as inferior due to the color of their skin (Dial, 1993).

For the Lumbee ancestors, the most important consequence of these trends was that Whites now viewed non-Whites as inferior and curtailed their rights and freedoms. Previous to these times in Robeson County, Whites had acknowledged the Lumbee ancestors as Indians, and had distinguished between the Lumbee and other American Indians because they adopted White ways (Dial, 1993). Although these two peoples shared a similar culture, Whites were beginning to view the Lumbee as different from them, mostly due to the color of their skin (Dial, 1993). Beginning in 1790, Lumbees were designated as “free persons of color” (Blu, 2001) or “other free persons” (Bailey, 2008). This designation would hold until the 1820 census, when Lumbees were categorized as ‘free colored” (Bailey, 2008). In the 1850 census, “mulatto” replaced “free colored” as “after 1850, the census takers were expected to judge race pragmatically: some recorded as ‘mulatto’ anyone who seemed to appear physically to have some nonwhite ancestry” (DeMarce, as quoted in Bailey, 2008, pp. 28–29). Non-Whites in Robeson County were to be grouped together regardless of their history or social position, as color was the only thing that mattered (Dial, 1993).

During these times, Lumbee ancestors suffered economically at the hands of Whites, as Whites found ways to use them as free labor or to legally take their lands (Dial, 1993; Dial & Eliades, 1996). Unsurprisingly, the economic status of the Indians declined with their declining legal status. The 1850 census reported that only half of the estimated 2,000 Lumbee families in Robeson County owned real estate (Dial, 1993).

The Indian settlement near present day Pembroke became known as Scuffletown, and the Whites referred to the Indians that lived there as Scuffletownians (Bailey, 2008; Oakley, 2005; Thompson, 1973). Thompson (1973) contends that during this time, a few American Indian children from Scuffletown and other American Indian settlements attended White subscription schools established near their settlements. In a subscription school, students paid the educators to attend (Dial, 2005). However, Thompson (1973) posits that most Indian children attended subscription schools run and supported by Indians. Although the 1835 amendments to North Carolina’s constitution did not specifically refer to Indians, all non-Whites were disenfranchised, including the Indians of Robeson County (Thompson, 1973). As well as losing the right to vote, Lumbee ancestors were denied the right to attend White schools (Thompson, 1973).

The actions of the 1835 Constitutional Convention forced the Lumbee ancestors into involuntary ignorance (Thompson, 1973). They were not allowed to attend White schools and could not afford their own schools due to new constrained economic standing. The franchise was restored in 1868, but Lumbee ancestors still suffered discrimination (Thompson, 1973). Although numerous efforts were made by from 1868 to 1885 to force Lumbee ancestors to attend Black schools, they "persistently refused to do so, preferring to grow up in ignorance instead" (Thompson, 1973, p. 35)

From the End of the Civil War (1865) until 1885

From 1835 to 1885, Lumbee ancestors suffered the inequities of discrimination (Dial, 1993; Dial & Eliades, 1996; Thompson, 1973). By the beginning of the Civil War, Lumbee ancestors could not bear arms, have their own schools, marry Whites, give evidence in courts against Whites, or serve on a jury of any kind (Dial, 1993; Dial & Eliades, 1996; Thompson, 1973). These actions precipitated by the 1835 Constitutional Amendments, contributed largely to the "Lowry Guerrilla War" that began during the American Civil War and continued into the reconstruction era. Dial (1993) states,

> Robeson County's civil war would last far beyond 1865, however, for the cessation of hostilities between the states of the North and South marked only the beginning of a kind of guerrilla warfare between the White establishment and the band of Lumbee—outlaws to some, Robin Hoods to others—bent on avenging past and present injustices. (p. 39),

The Lowery Gang forges an Indian identity. Many scholars of the Lumbee discuss Henry Berry Lowery and his place in Lumbee history. At the beginning of the Civil War, Lumbee ancestors supported the Confederacy (Oakley, 2005). However, classified as "free persons of color," they could not legally own firearms and thus the military could not issue them guns (Oakley, 2005). Rather, the Confederate Government conscripted Indians as manual laborers, as plantation owners did not want to give up their slaves for that purpose. The Confederacy sent Lumbee ancestors to Wilmington, NC to help build Fort Fisher, which was intended to protect the mouth of the Cape Fear River (Oakley, 2005). Malnourished and mistreated, many Lumbees fled the camps and returned to Robeson County to hide out in the swamps (Oakley, 2005). In these swamps, the Indians created refugee camps where they were soon joined by runaway slaves and Union soldiers who had escaped from South Carolina prisoner-of-war camps (Oakley, 2005). As the war continued, Henry Berry Lowery assumed leadership of one of these refugee groups and raided prominent local planters for provisions. Henry Berry's father Allen was a prominent Indian farmer (Dial, 1993). The gang included several of Henry Berry's relatives and at least two former slaves (Oakley, 2005). Henry Berry's gang could be violent, and history connects them with several altercations and murders. During these times, the Confederate Home Guard was the local militia charged with keeping the peace (Oakley, 2005). The home guard scoured the swamps looking for Henry Berry and his gang, and succeeded in capturing him several times; but he always managed to escape (Oakley, 2005).

The Civil War ended in 1865, but the gang's activities continued (Oakley, 2005) and resulted in the posting of bounties for their capture. In 1872, Henry Berry disappeared and was never seen again (Dial, 1993; Dial & Eliades, 1996; Oakley, 2005). Speculations about his disappearance are numerous, but no verifiable facts support any of these claims.

Henry Berry's gang forced Whites to counter their armed assaults with cultural and political changes (Thompson, 1973). Many Whites felt that continuing their discrimination and injustices against Lumbee ancestors would force these "Indian Cutthroats" (Bailey, 2008, p. 20) into armed revolt a second time (Thompson, 1973). To prevent such rebellion, Whites granted the Lumbee ancestors political identity and entered into an era of political accommodation with them (Oakley, 2005). Towards the end of reconstruction, North Carolina's new Democratic Party quickly recognized the significance of the Lumbee ancestors' political power, and began a political alliance with them (Thompson, 1973). This political accommodation and alliance would lead to separate school systems for Blacks, Whites, and Indians in Robeson County.

In addition, Henry Berry's gang has historical significance beyond the political power he helped establish for the Indians of Robeson County. He helped shape the identity of Lumbee ancestors as Indians (Bailey, 2008). When Henry Berry became an outlaw in 1864, Whites categorized Lowry and other Scuffletownians as mulattos rather than Indian. Sider (2003) gives Henry Berry credit for resurrecting the public image of the Lumbee ancestors as Indians, calling him "a shape-changer, a hero who could not only change his own shape . . . but who changed the shape of a whole people" (p. 158).

Historian William McKee Evans studied the actions of Henry Berry and his gang (Bailey, 2008). Evans, like Sider, argues Henry Berry's importance in establishing Lumbee ancestors as Indian (Bailey, 2008). According to Evans, Henry Berry "gave the Indians the sense of being a people" (Evans, as cited in Bailey, 2008, p. 20).

The reconstruction era. After the end of the Civil War, in the year 1868, North Carolina courts ruled that the 1835 Constitutional Amendment did not apply to the Lumbee ancestors. Republicans founded the North Carolina Party in 1867, and were instrumental in producing the North Carolina Constitution of 1868 (Thompson, 1973). Some of the most important provisions of this new constitution were the abolition of slavery, universal manhood suffrage, elimination of religious and property qualifications for voting, and provisions for general and uniform public schools to be open for at least four months a year (Thompson, 1973). Although the new constitution restored suffrage to the Lumbee ancestors, it did little for educating either Indian or Black children (Thompson, 1973). The constitution provided for public schools, however it did not specifically provide for the segregation of races within the schools (Thompson, 1973). Consequently, the upper class refused to support the public schools of North Carolina. Additionally, the planters viewed private education as the only way of educating their children, and therefore public schools in eastern North Carolina floundered for all races (Thompson, 1973). Reconstruction ended in 1875 (Davis, 1986), and North Carolina began to establish public schools at a time when Democrats had gained political control of the state (Thompson, 1973).

The decade of despair (1875 to 1885). Beginning in 1868, the Democrats suppressed the development of public schools in opposition to the Republican Constitution, which did not guarantee the separation of races (Thompson, 1973). In 1875, the Democrats gained political control of North Carolina and revised the Republicans' 1868 liberal Constitution. The Democrats' revised Constitution outlawed the mixing of races, and provided for segregated schools for Blacks and Whites (Thompson, 1973). However, the new constitutional revisions did not provide for separate Indian schools. Whites assumed that Indians, legally classified as "people of color," would attend Black schools (Dial 1993; Dial & Eliades, 1996). Lumbee ancestors viewed attempts to enroll their children in Black schools as an overt denial of "their special identity and heritage, as well as a continuation of the discrimination to which they had been subjugated since the enactment of the Free Negro Codes in 1835" (Dial, 1993, p. 57). Lumbee ancestors refused to send their children to the Black schools (Dial, 1993). Dial (1993) argued the Lumbee ancestors resisted attending Black schools, not out of prejudice, but rather in defiance of White-imposed definitions of Indian racial identity and inferiority.

Whatever their level of prejudice for Blacks, Lumbee ancestors opposed the North Carolina government and insisted on separate schools for their own people (Dial 1993; Dial & Eliades, 1996; Thompson, 1973). From 1868 to 1875, little progress was made in educating any North Carolina child as Democrats opposed the Republican state constitution, which lacked any statement supporting racial segregation in schools (Thompson, 1973). Between 1875 and 1885, Lumbee ancestors refused to send their children to Black schools created by the Democrats' 1875 Constitutional revisions providing for segregated schools (Thompson, 1973). Present day Lumbee refer to the years between 1875 and 1885, when the State of North Carolina did not provide them schools of their own and tried to make them attend Black schools, as the decade of despair (Davis, 1986; Dial, 1993; Thompson. 1973).

The Lumbee Acquire State Recognition and a School System

Beginning in 1863, Hector McMillan investigated the genealogy and history of the Lumbee ancestors and initiated a detailed study of their customs, habits and traditions (Davis, 1986; Dial, 1993). McMillan inferred that the Lumbee ancestors were descended from Raleigh's lost colonists and a tribe of Indians he termed the Croatans (Davis, 1986; Dial, 1993; Thompson, 1973). McMillan brought legislation before the North Carolina General Assembly containing two provisions: 1. The Lumbee ancestors were officially named The Croatan Indians of Robeson County (Davis, 1986; Dial, 1993; Thompson, 1973). 2. The second provision stated:

> That said Indians and their descendants shall have separate schools for their children, school committees of their own race and color, and shall be allowed to select teachers of their own choice, subject to the same rules and regulations as are applicable to all teachers in the general school law. (Laws of North Carolina, 1885, as cited in Thompson, 1973, p. 42)

Passed in 1885, this legislation had little immediate effect for the education of Robeson County Indians. As few Indians had received schooling for the previous 50 years, their illiteracy rates were high and few Indians had enough education to teach (Dial, 1993; Thompson, 1973).

The Croatan Indian Normal School

Once again, McMillan brought the plight of the Lumbee ancestors to the attention of North Carolina's General Assembly. McMillan sponsored a bill to establish an Indian normal school in Robeson County, and the bill was signed into law in 1887 establishing The Croatan Normal School (Dial, 1993; Thompson, 1973). The law provided $500 to pay the normal school's instructors, but the bill did not allocate monies for construction of a building (Dial, 1993; Thompson, 1973). Instead, the bill stipulated that unless the Indians provided a building by the following general assembly session, the law would be repealed (Thompson, 1973). Therefore, if the Indians wanted their Normal School, they would need to build it themselves. Seven Lumbee ancestors were appointed trustees of the Normal School (Dial, 1993).

The Croatan Indians donated $1,000 in materials and labor, and the Croatan Normal School opened with 15 students in 1887. W. L. Moore, a respected Methodist minister who had trained at another normal school, became the first principal (Dial, 1993; Thompson 1973). The normal school was located about one mile west of present-day Pembroke and grew into the University of North Carolina, Pembroke (UNC Pembroke) (UNC Pembroke, 2013). Although the school was not awarded standard normal school status until 1928, the school did prepare teachers who were at least more literate than other members of the Indian community.

During the early stages of its existence, the appellation of the normal school at Pembroke mirrored the name of the Tribe itself. In 1909, the Board of Trustees decided to move the Normal School to Pembroke, which was the center of one of Robeson

County's Indian Communities (Dial, 1993; Thompson, 1973). Two years later, the name of the Normal School changed. Local Whites had begun to shorten the local name Croatan to *Cro*. Dial (1993) speculated that Whites used the appellation *Cro* because of its resemblance to *Jim Crow*. Jim Crow was an informal name for the southern laws that imposed segregation, as well as other social injustices on non-Whites. The Croatan Indians considered Cro to be a racial slur, and in 1911, North Carolina's legislature dropped Croatan from the tribe's official name. The tribe became The Indians of Robeson County and their normal school became The Indian Normal School of Robeson County (Dial, 1993). In 1913, the legislature renamed the Indians of Robeson County as The Cherokee Indians of Robeson County based on several scholars' theories that early in the 18th century; some Cherokees had integrated with the ancestors of the Lumbee (Dial, 1993). The school retained this name for 28 years (Dial, 1993; Dial & Eliades, 1996).

In 1941, recognizing the institution's progress, the North Carolina Legislature renamed the Normal School as Pembroke State College for Indians (Dial & Eliades, 1996; Thompson, 1973). The Legislature changed the name to Pembroke State College in 1949 (Dial & Eliades, 1996; Thompson, 1973). Since its inception in 1887, the school had limited its enrollment to the Indians of Robeson County and surrounding areas. However, beginning in 1945, Pembroke began to admit Indian students from any federally recognized Indian group. At that time, Pembroke was the only tax-supported four-year college for American Indians in the United States (Dial & Eliades, 1996; Thompson, 1973).

In 1969, the General Assembly of North Carolina changed the institution’s name to Pembroke State University as it granted the institution regional university status (Dial & Eliades, 1996; Thompson, 1973). In 1972, Pembroke became one of the 17 constituent institutions of the University of North Carolina System, and in 1997 the institution’s name changed to UNC Pembroke (UNCP) (UNC Pembroke, 2012). On July 5, 2005, North Carolina Governor Mike Easley signed into law UNC Pembroke’s status as North Carolina’s Historically Native American University (Prine, 2012).

A History of the Lumbee People after 1885

As stated above, the history of the Lumbee people and the history of their schools are inseparable (Davis, 1986). Additionally, it is important to present their history and the history of their social institutions as situated within the context of the history of the United States of America generally, and the within the context of the history of the southern United States particularly (Blu, 2001). Therefore in the text that follows, I have attempted to integrate the history of the Lumbee People and the history of their separate school system.

From 1885 through the End of World War I

Generally, between 1885 and 1900, the citizens of Robeson County paid little attention to public education (Thompson, 1973). The county’s educational efforts were handicapped by “poverty resulting from the Civil War, low income, a scattered population, poor roads, a large rural population in comparison with the number of taxpayers, and the added necessity of maintaining a tri-racial school system” (Thompson, 1973, p. 48). Adding to the poverty of Robeson County was the decline of the turpentine industry. Prior to the Civil War, the gathering of turpentine from the pine forests of Robeson County was profitable (Dial, 1993). However, during Sherman's March through South and North Carolina, he ordered his troops to burn these pines. The destruction of these pine forests effectively destroyed an important local economy for the Lumbee. The depressed economic conditions, especially agriculture, caused many Lumbee to migrate to other southern states. However, leaving Eastern North Carolina did not solve many problems for these immigrants. During this period, segregation was being institutionalized throughout the South; it was a fact of life for Lumbees, no matter where they chose to live. These American Indians witnessed the burgeoning of social and political segregation that marked the South's history during this time (Dial, 1993; Dial & Eliades, 1996).

In addition to the problems faced by the schools of all three races, the Lumbee schools faced other problems. Indian children did not receive any education after elementary school, as no college or technical school in the state admitted Lumbee children, although agricultural colleges, mechanical colleges and academic colleges were open throughout the state for Whites and Blacks. Until the Normal School began offering high school work in 1924, the Indians received only elementary level education in their one-room schools and at the Normal School (Thompson, 1973). Some Robeson County Indians attended the Carlisle school in Pennsylvania and Haskell Institution in Kansas, but most Indians were too poor to leave their homes (Thompson, 1973).

Despite the many hurdles facing the Indians, they made progress. In a 1895 report to the State Superintendent of Public Instruction, the Robeson County

Superintendent reported that the number of Indian children attending school had increased by 42%, and he also reported that “with a splendid Normal School, the number and efficiency of their teachers have been largely increased and they show much gratifying progress in every respect” (Minutes of the Robeson County Board of Education, June 3, 1895, as cited in Thompson, 1973, p. 49). The Indians continued to build schools as the number of teachers prepared by the Normal School continued to grow (Dial, 1993; Dial & Eliades, 1996; Schierbeck, 1980; Thompson, 1973).

During the years that marked the transition between the 19th and 20th century, the town of Pembroke was founded (Dial & Eliades, 1996). Pembroke originated at the crossroads of two major railroads, and was incorporated by legislative action in 1895, quickly becoming an economic center for the surrounding Lumbee communities. When the Normal School was moved to Pembroke in 1909, its importance grew. Although Pembroke quickly became the focal point of Lumbee business activities, most of these American Indians remained rural. Cotton was the predominant crop in the 19th century. However, beginning in the late 1890s, tobacco began to replace cotton as the principal money crop. By the 1920s, tobacco had become the most profitable Lumbee crop. When the United States entered the First World War (WWI), some Lumbee men became soldiers, and 13 Lumbee soldiers were killed in France. WWI veterans returned to Robeson County to find little had changed. Segregation and discrimination still ruled local society, and farming was practically the only economic activity available to them (Dial & Eliades, 1996).

The Great Depression

For most Americans, and especially farmers, the 1920s were not prosperous. American agriculture bloomed during WWI as demand for food from war-torn Europe created high export prices, but the 1918 peace resulted in a crash in American agricultural commodity prices that continued throughout the 1920s and 1930s (Dial, 1993). Farming continued to suffer under the business-oriented federal administrations of the 1920s. As did most of their American counterparts, Lumbee farmers suffered from low prices, limited markets and high tariffs (Dial & Eliades, 1996). The stock market crash did not initially affect Lumbees as much as some other Americans, as few Lumbee owned stocks. However, the depression and its massive unemployment and dislocations intensified the Lumbees' already existing agricultural problems as prices continued to drop and credit became harder to obtain. Some Lumbee farmers and families managed to eat because of their gardens and livestock. However, some Lumbee farmers lost their lands in order to pay debts. Lumbee who were not farmers took whatever jobs they could find, which included New Deal programs such as the Work Progress Administration (Dial & Eliades, 1996).

By 1920, the Indian school system had 20 schools, most of which offered only the first four years of elementary school (Schierbeck, 1980; Thompson, 1973). However, economic hardships began to manifest themselves within the administration of Robeson County schools. In 1925, the Robeson County Board of Education called for a county-wide consolidation of all its schools (Thompson, 1973). Many Indian communities bitterly contested consolidation of their schools, as they did not want to lose the school buildings which served as meeting places for various community gatherings. In a 1930 biennial report, the superintendent seemed to indicate that while consolidation might be effective for White schools or Black schools, he questioned its effectiveness for Indian children (Schierbeck, 1980). During the Great Depression, he noted that “as a large percent of the Indians in Robeson County are tenant farmers and move about very often, it is difficult to arrange permanent school buildings for them” (Robeson County School Budget, 1930–1931, as cited in Schierbeck, 1980, p. 261). Many Lumbee farmers were forced to become tenant farmers when they lost their land (Sider, 2003). Nevertheless, in 1933, at the height of the Great Depression, Robeson County consolidated 38 Indian schools into 14 schools (Schierbeck, 1980; Thompson, 1973). From 1930 to 1940, the Indians increased the number of their schools that offered high school courses from three to seven. By the end of this decade, the Indians of Robeson County had 25 schools, five of which were brick (Thompson, 1973).

World War II Initiates Great Social Changes

When the United States entered World War II (WWII), Lumbee youth enlisted in the armed forces. Forty Lumbee died for their country, which had not accepted them as first-class citizens for over a century. WWII precipitated social change in the Lumbee community (Dial & Eliades, 1996). Pembroke was within 40 miles of two major military installations during the war: the Laurinburg-Maxton Air Base and Fort Bragg. Soldiers with weekend passes found their way to this American Indian town. Lumbee women married White soldiers. Also, American Indians from other parts of the United States were stationed at either Maxton or Fort Bragg. These American Indians from other tribes married Lumbee Indians (Dial & Eliades, 1996). Lumbee soldiers brought non-Indian brides home from all over the world (Dial, 1993). Thus, the provincialism and isolation of the Lumbee communities were diminished by the effects of WWII (Dial, 1993; Dial & Eliades, 1996).

The end of the depression and the beginning of WWII marked the beginning of another large migration of Lumbee away from southeastern North Carolina. During this time, many Lumbee migrated to Detroit or Baltimore. Baltimore was only 300 miles from home, and Detroit (the center of the nation's automobile industry) offered almost certain employment. Although by the 1940s, national prosperity was restored, there was little economic opportunity for the Lumbees of southeastern North Carolina unless they chose to farm (Dial, 1993). The migratory trend to northern cities, begun in the 1930s, was accelerated in the years after WWII (Dial & Eliades, 1996).

The economic boom initiated by WWII essentially ended the great depression. The war forced the depressed U.S. economy to expand its productive capacity, and this economic expansion continued after the close of the war. The peacetime populace demanded automobiles, washing machines, and other consumer goods. Meanwhile, the U.S. government needed weaponry and technology to fulfill its new international responsibilities, and also to help guarantee that prosperous economic times would continue. Thus, the nation's plants and factories needed tremendous manpower, and many southern Blacks went north believing they would find greater economic opportunity, and also a less racist society; as did many Lumbee. Lumbee servicemen returning home from service were a significant part of this trend (Dial, 1993).

The Era of Integration

Although WWII began to weaken racial barriers for non-White soldiers and veterans, the Lumbee veterans that did return home to Robeson County found the institution of segregation relatively unchanged (Dial & Eliades, 1996). Until 1954, "Jim Crow" signs were prominent in Robeson County, except in Pembroke. "Public restrooms were marked *white*, *Indian*, and *Negro*. Water fountains were designated by race. Public accommodations such as restaurants were segregated" (Dial & Eliades, 1996, p. 157). However, beginning in the late 1940s, the federal government began to pay some attention to civil rights issues. This federal attention to civil rights issues lead to the *Brown Decision* of 1954 (Dial & Eliades, 1996). The *Brown Decision* ruled that segregation in public schools was inherently discriminatory, and it also abolished the doctrine of separate but equal, which laid the groundwork for the abolition of segregation in public institutions and facilities (Dial, 1993). The Lumbee reaction to the *Brown Decision* was complex. Although they desired the dismantlement of a legal system that defined them as second class citizens, Lumbees worried that admitting non-Indian students would change the special characteristics of the separate Lumbee school system they had fought so hard to establish (Dial, 1993).

The federal government recognizes the Lumbee. Concurrently with the blossoming civil rights movement, Lumbees began searching for a new name for their people. They had been known as The Cherokee Indians of Robeson County since 1913. Meetings were held, and *Lumbee* was chosen as a possible new name. A referendum was called, and although the turnout was low, the vote approved the new name. As a consequence, in 1953, the North Carolina general assembly passed a law designating these American Indians as the Lumbee Indians of North Carolina. In 1956, the United States congress followed the North Carolina general assembly's lead (Dial & Eliades, 1996). Dial (1993) states,

> Though the choice of the name Lumbee did not end the anthropological controversy over their origins, or satisfy those members of the tribe who sought to identify themselves as descendants from a single ancestral people, it did express who and what the Lumbee are: They are people of the river. Just as, for decades, they had made their homes on its banks, they found definition in its name (Dial, 1993, p. 95).

The Lumbees and the state of North Carolina react to the *Brown Decision*. Although the *Brown Decision* occurred in 1954 and outlawed racial segregation of schools, between 1940 and 1966, the state of North Carolina and Robeson County continued to provide funds that were used for constructing, renovating, and maintaining the separated White, Black and Indian school systems within Robeson County. However, Black and Indian schools remained inferior to the schools for Whites because of inequitable funding (Schierbeck, 1980). There was no real impetus for desegregation in Robeson County schools until about 1965 (Schierbeck, 1980). However, Schierbeck (1980) argued that it was only after the *Brown Decision* that the state and county began to improve the segregated schools of both Blacks and Indians. Seemingly intent upon perpetuating separate schools within the County, and continuing to ignore the *Brown Decision*, the State of North Carolina and the Robeson County Commissioners continued to pass local bond issues and support state bond issues that maintained separate school systems.

The Lumbee feared integration of public schools, as many felt that the survival of the Lumbee as a separate ethnic group was tied to their educational system (Massey, 1996; Oakley, 2005; Thompson, 1973). Lumbee communities were forced to use their own resources to build and maintain their Indian schools. Because of their sacrifices to create their own schools, the schools became both geographic and social centers for the Indian communities that ultimately defined Lumbee identity. Thompson (1973) estimated that, through the years, the Lumbee had raised over $1 million to support their communities' schools.

In addition to the Robeson County Schools, there were, in the early 1970s, five other School Districts within Robeson County (Thompson, 1973). These districts were created by the North Carolina Legislature and were associated with the following towns or cities: Lumberton, Red Springs, St. Paul's, Fairmont and Maxton. Each of these five urban school districts had considerable autonomy and the boundaries of their districts were set by legislative actions (Massey, 1996; Thompson, 1973). These boundaries extended outside the corporate boundaries of each city, and the Robeson County Administrative Unit administrated all those areas not included within urban district boundaries (Massey, 1996; Thompson, 1973). There were no Indian schools in the urban administrative units, although in 1970, Lumbee children comprised 61.5% of the students under the management of the Robeson County Administrative Unit (Massey, 1996). Indian children were bused from within urban districts to the Lumbee schools in the Robeson County Administrative Unit (Massey, 1996; Thompson, 1973).

Although the United States Supreme Court declared segregation unlawful in 1954, Black, Indian and White children of Robeson County continued to attend segregated schools until 1970 (Massey, 1996;Thompson, 1973). The Department of Health, Education and Welfare (HEW) demanded that the school districts be desegregated by the beginning of the 1970 to 71 school year (Massey, 1996; Thompson, 1973). Faced with HEW's threat of withholding federal aid to the school boards of Robeson County, the boards entered into an agreement with HEW. The school boards promised to enforce strict assignment of all students to schools solely according to the students' residence within a given district (Massey, 1996; Thompson, 1973).

In late August of 1970, Robeson County school officials implemented desegregation plans. Many Lumbee parents defied orders that transferred their children to previously non-Indian schools (Massey, 1996; Thompson, 1973). Approximately 500 Lumbee children protested with sit-ins at their traditional Lumbee schools. Despite being denied registration and books, they returned day after day. Robeson County school officials warned the protesting parents that they risked incarceration for refusing to send their children to their assigned schools. In September 1970, many Lumbee parents decided to discontinue their involvement in the sit-ins to pursue other tactics (Massey, 1996). Several Lumbees filed a lawsuit against HEW for its approval of Robeson County's school desegregation plan, maintaining the plan required few Black or White children to transfer to Lumbee schools, while many Lumbee children were forced from their traditional Lumbee schools. In addition, the Lumbee also argued that the *Brown Decision* and subsequent legislation was intended to help Blacks in the South, but that implementing the desegregation plan endangered the future of many Indian schools. Also, the lawsuit emphasized the importance of separate Lumbee schools for maintaining traditional Lumbee Indian culture (Massey, 1996; Oakley, 2005). The Lumbee lawsuit did not limit their complaint to unfair desegregation. Their lawsuit clearly stated that Lumbees wanted to stay in their traditional schools, as these schools were integral parts of their cultural identity as American Indians (Massey, 1996; Oakley, 2005). The Lumbee's lawsuit ultimately failed (Massey, 1996; Oakley, 2005).

The Lumbee schools are forced to desegregate. Despite all the efforts of some Lumbees and national American Indian activist groups, the Lumbee schools in Robeson County were desegregated (Massey, 1996). Massey (1996) argued that this was not surprising, as school desegregation was a national reform that entire states failed to avoid. However, the Lumbee continued to hope that they could reform their local desegregation plan so Whites might share more of the burden of desegregation (Massey, 1996). By 1972, most Lumbee parents abandoned their sit-ins and other protests as these demonstrations failed to make the Robeson County Board change its new school district lines (Massey, 1996). Despite all resistance, by 1973, federal civil rights laws had forced integration upon the Lumbee schools. In 1989, the six school systems existing in Robeson County were merged, and became the Public Schools of Robeson County (Bryant, 2011).

The 1970s and 80s

While the Lumbee struggled to retain their separate school system, other significant events were shaping the history of the Lumbee community. In 1971, the first

Indian-owned bank in the United States opened in Pembroke, and many people of all races and corporations across the United States now do business with the Lumbee Bank (Dial & Eliades, 1996). Dial and Eliades (1996) argue that the opening of this bank made the non-Indian banks in the area more considerate of their Lumbee customers. Also, in the 1970s, the *Carolina Indian Voice* began publication. This Indian owned newspaper gave the Lumbees their own independent source of news and self-expression. In the 1970s, Lumbee ownership of land reached levels not seen since the 1730s. Therefore, there was a decline in tenant farming. Lumbee farmers diversified from raising tobacco, and began to grow other money crops such as soybeans, cucumbers, tomatoes, green peppers and raise more livestock for market (Dial & Eliades, 1996).

The 1990s

For decades, agriculture was the most important economic activity of the Lumbee. Traditionally, many Lumbee depended on subsistence farming on their own or rented land, or sharecropping with other Lumbee landowners. But this agricultural economic base began to change in the latter part of the 20th century (Ross, 1999). At the close of the 1990s, less than 5% of the workforce was agriculturally related. Although manufacturing was insignificant in Robeson County until the 20th century, by the 1990s more than 40% of the Lumbee workforce was engaged in manufacturing and 18% were in the construction trades. Lumbee take great pride in “hanging sheet rock,” and their skill is known throughout the region (Ross, 1999). In addition, in the 1990s, 16% of the Lumbee workforce was employed in service or professional activities. But despite these employment numbers, in the 1990s employment was a serious problem for the Lumbee.

During this time period, Robeson County experienced some of the most consistently high unemployment rates in the state (Ross, 1999). The North American Free Trade Agreement (NAFTA) was passed in 1993, and by the end of the 1990s, Robeson County had lost more than 1,000 jobs, as many textile and other plants with low skill requirements moved to Latin and Caribbean America (Ross, 1999).

Robeson County Enters the 21st Century

Robeson County is the most ethnically diverse rural county in the U.S. (Hossfeld, Legerton, & Keuster, 2004). As of 2003, the county's poverty rate was 24% and the illiteracy rate was 38%. Despite these racial, economic and social challenges, Robeson County has made tremendous progress towards racial inclusion and representation in all levels of government, perhaps more progress than most other North Carolina counties (Hossfeld et al., 2004). In the decades following the passage of NAFTA in 1993, Robeson County's economic and social conditions significantly declined resulting in the most serious economic and social crisis since the Great Depression. In 1993, manufacturing accounted for 31% of all jobs in the county. Between, 1997 and 2000, Robeson County lost 41% of its manufacturing, and between 1993 and 2004, the county lost approximately 8,708 manufacturing jobs (Hossfeld et al., 2004). Plant closures peaked between 1998 and 2003, with nine plant closings reported in 2003, and manufacturing jobs decreased to only 18% of the total. As a result, by 2004, regional household income was reduced by $674 million per year**.** As American Indians have historically been a large part of the blue-collar workforce in Robeson County, plant closings affected them inordinately (Hossfeld et al., 2004).

Some other statistics document the recent socioeconomic decline in Robeson County: The public school annual dropout rate has increased from 9% in 1990 to 11% in 2000. As of 2002, 30% of the county's residents do not have access to health insurance. Twenty-six percent of the American Indian children in Robeson County live in poverty. The issuance of food stamps, free school lunches, and child recipients of Medicaid have all increased since the early 1990s (Hossfeld et al., 2004).

The Lumbee Tribe in 21st century Robeson County. The 2010 U.S. Census shows that Robeson County remains racially diverse with American Indians representing the largest percent of the population. Current county racial makeup is as follows: White: 29%, American Indian, 38%, Black, 24%, Hispanic, 8% (U.S. Census Bureau, 2010). The county is still largely rural, as the 2010 census reports that 65 % of the entire population lives in areas designated by the U.S. Census Bureau as rural, while 81% of the American Indians in Robeson County reside in rural areas. The U.S. Census estimates that only 2% of these American Indians live on farms (U.S. Census Bureau, 2010). The unemployment rate for the county is 13% currently (North Carolina Division of Employment Security, 2013). Recent estimates of percent of Robeson County population living below poverty level are as follows: White, 23%; African American, 36%; American Indian, 30%. The per capita income level for Robeson County is currently about $15,689 as opposed to a North Carolina state level of $25,256.

In summary, present day Lumbee continue their social and economic struggles. While racial discrimination slowly becomes a less important obstacle to the Lumbee, their struggle for educational and economic equality, particularly as compared to Whites, continues.

The Lumbee Tribe in 21st century Robeson County schools. Orfield et al. (2004) argue that the most useful and accurate way to estimate high school graduation rates is to use the actual enrollment data that school districts provide annually to the nation's Core of Data. Using this data, Orfield et al. (2004) developed the Cumulative Promotion Index (CPI), which they consider more accurate than the method developed by the U.S. Department of Education; used by most states.

For the 2002–03 school year, North Carolina reported a graduation rate of 97.0% (Orfield et al., 2004). However, using CPI, Orfield et al. (2004) estimated that North Carolina's 2000–01 graduation rate was 63.5%. When broken down by race, North Carolina's graduation rates were as follows: White students, 69.2%; African American students, 53.6%; Latino/a students, 58.4%; Asian students, 68.3%; American Indian students, 33.8%. American Indians in North Carolina consistently have low graduation rates, ranging from 4.8% to 40.0% (Orfield et al., 2004). Orfield et al. (2004) reviewed North Carolina's 10 largest school districts, and Robeson County was the lowest performing. They found a graduation rate of 34.7% for American Indians in Robeson County. Other minority groups within Robeson County also fared poorly, with Whites graduating at a rate of 45%; African Americans at 36.4%; Asians at 30.3%, and Latino/as at 9.7%.

American Indians in Robeson County graduate at a very low rate. Additionally, their performance in the classroom can often be lower than that of Whites. Given the history of the schools in their county, this is not surprising, and does not reflect on the desire of the Lumbee Tribe to educate their children. As a rough indication of this inequity, I have chosen to use the analysis of the biology end-of-course test given at Lumberton Senior High School and Purnell Swett High School for the school year 2010 to 11. This rough analysis serves as a comparison of how various ethnicities in Robeson County perform in science. I chose Lumberton Senior High School because it has a significant urban White population, and I chose Purnell Swett High School because it has a significant rural Indian population with rural Black and White minorities (see Tables 2 and 3; NCDPI, 2011).

Table 2

Number and Percent of Students at or above Achievement Level III in Biology at Lumberton Senior High School

Student Subgroup	Number of Valid Scores	Number at or Above Level III	Percent at or Above Level III	Average Scale Score
All Students	501	312	62.3%	148.5
American Indian	162	88	54.3%	146.5
African American	175	90	51.4%	146.8
Hispanic	28	18	64.3%	148.9
White	130	111	85.4%	152.6

Note. Students taking multiple-choice tests.

Table 3

Number and Percent of Students at or above Achievement Level III in Biology at Purnell Swett High School

Student Subgroup	Number of Valid Scores	Number at or Above Level III	Percent at or above Level III	Average Scale Score
All Students	402	268	66.7%	148.9
American Indian	311	209	67.2%	149.1
African American	60	36	60.0%	146.6
Hispanic	0	0	0.0%	0.0
White	10	7	70.0%	154.2

Note. Students taking multiple-choice tests.

These data indicate that the various minority groups perform about the same on the biology end of course test as measured by % at or above Level III at both schools. However, American Indians, African Americans and Hispanics all perform at least 20% below the level of Whites at Lumberton Senior High School. Interestingly, at Purnell Swett High School, where Indians are a large percentage of the students, Indians and African Americans performed higher than their peers at Lumberton. Hispanics were unrepresented in this sample. Further, rural Whites did not perform as well as their urban counterparts in Lumberton. These data suggest that the effects of decades of educational discrimination have not yet been overcome, and that Lumbees and other minorities still have much to expect of the public schools with reference to their science education. It also seems to indicate that students do better in science when their ethnicity represents a significant proportion of their school's population.

The Future

I have briefly described a history of Lumbee American Indians. Overall, the pattern is one of initial acceptance by Whites followed by a catastrophic loss of real property, as well as political and educational status during the 1800s. The 1900s have shown a steady increase in the status of the Lumbee. This elevation in status has been brought about by hard work and the determination of the Lumbee to be recognized as a legitimate American Indian people, and their determination to provide an excellent education for their children. While there is still much to be achieved with regard to these issues in the 21st century, the Lumbee community is currently in a better position than it has been since the 1700s.

In Chapter IV I will provide a purpose for this study, a list of research questions, and discuss the environment of the HRE as a study site. Also, I will describe the participant selection process and provide information about Lumbee participants and their HRE research groups. I will detail methodologies used to collect and analyze data appropriate to answering my research questions.

CHAPTER IV

METHODOLOGY

Chapter IV provides a purpose for the study and a list of research questions, and discusses the environment of the HRE as a study site. Additionally, participant selection is described and information about Lumbee participants and their HRE research groups is provided. Also, the methodologies used to collect and analyze data appropriate to answering the research questions are detailed.

Purpose

The purpose of this mixed methods ethnographically inspired study of a single case (Creswell, 2007; Creswell & Plano Clark, 2011) was to investigate the participation of Lumbee youths in a specific HRE for rising ninth through twelfth graders. The HRE offers an informal science education environment. The participation of Lumbee youths was studied within the framework of Community of Practice (CoP) and Funds of Knowledge (FoK). Specifically, the intent was to investigate how the FoK of the Lumbee youths helped them make contributions to the HRE CoP. Elucidating the rural FoK of these youths enabled an understanding of their ability to make significant contributions to the HRE CoP. Such contributions by newcomers have been rarely reported in the literature. Also, the study was designed to demonstrate the affordances that the HRE provided the Lumbee youths as they learned about reptiles and amphibians, specifically, and science in general.

Research Design

I determined that this research was essentially a case study because it involved "The study of an issue explored through one or more cases within a bounded system" (Creswell, 2007). Here, there is a single case (the Lumbee participants who attended the SCR HRE) with multiple sources of data (audio and video observations, field notes, interviews, surveys, and knowledge tests). Further, a case study "reports a case description and case-based themes" (Creswell, 2007, p. 73). Within this single case, the design of data collection was ethnography. Creswell (2003) defines ethnography as qualitative research that studies an "intact cultural group in a natural setting over a prolonged period of time by collecting, primarily, observational data" (p. 14). Such studies describe and interpret "shared and learned patterns of values, behaviors, beliefs, and language of a cultural-sharing group" (Creswell, 2007, p. 68). While the aim of ethnography is to describe an entire cultural group, such groups may be as small as a few individuals. While certainly individuals in their own right, the Lumbee youths were members of an American Indian tribe. Additionally, they were together long enough to become members of other cultural-sharing groups such as their own research group, and the HRE CoP. The process of ethnography involves "extended observations of the group, most often through participant observation, in which the researcher is immersed in the day-to-day lives of the people and observes and interviews the group participants" (Creswell, 2007, p. 68).

I believe that ethnography was an appropriate choice for the qualitative strand of my embedded design. Creswell (2007) notes that ethnography is unique among qualitative research approaches, as it “advocat[es] the use of quantitative surveys and tests and measures as part of data collection” (p. 131). I embedded quantitative data within a qualitative ethnographic study. Creswell and Plano Clark (2011) termed such studies as embedded design variants, generally, and when used with ethnography, specifically as mixed methods ethnographic studies. In my study, the qualitative data strand took priority and explored the Lumbee youths’ contributions to the HRE CoP and the contributions of the CoP to the Lumbee youths. The quantitative strand provided a broader understanding of these Lumbee youths by providing their before-HRE and after-HRE self-assessments, thus enriching the qualitative descriptions of these youths (Creswell, 2003).

I attempted to describe how the Lumbee youths used certain cultural practices (FoK) to contribute to, and learn from the SCR HRE. In addition, I, as a researcher, was in the same setting as the Lumbee youths for the entire length of their participation in the HRE. Fieldwork is an integral part of ethnographic studies (Creswell, 2007; Willis, 2007). During my fieldwork at the SCR HRE, I accompanied the same group of students into the field for each morning activity. I also attended each evening elective if Lumbee students selected that elective. Thus, my study occurred in the “natural environment” of the HRE, and not in an “artificially contrived setting” (Willis, 2007, p. 235). During the week’s fieldwork, audiotapes and videos and field notes were generated. All participants were interviewed at the end of the week (Creswell, 2003; Creswell, 2007; Creswell & Plano Clark, 2011, Willis, 2007).

In terms of data collection and analysis, my study was concurrent (Creswell, 2003). Concurrent designs can be utilized when qualitative and quantitative data are collected within the same timeframe and subsequently analyzed at a later timeframe. In this design, the analysis of one data type does not affect the data collection, analysis or interpretation of the other data type. The results of the two data sets are integrated during the interpretation phase of the study (Creswell, 2003; Creswell & Plano Clark, 2011). Qualitative and quantitative data were used to assess specific research questions, which are listed below.

1. What FoK did these Lumbee youths bring to the SCR CoP? *(FoK)*
2. How did these Lumbee youths come to have these FoK? *(Source)*
3. How did these Lumbee youths leverage their FoK? (*Leverage*)
4. How did these Lumbee youths contribute to the SCR CoP? *(Contributions)*
5. How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? *(Benefits)*

Program Description

Herpetology Education in Rural Places and Spaces (The HERP Project)

My dissertation research was conducted under the greater umbrella of a National Science Foundation (NSF)-funded informal herpetological education project, Herpetology Education in Rural Places and Spaces (The HERP Project) (Grant No. DRL-1114558). This initiative was designed to promote herpetological education and conservation in the state of North Carolina, with emphasis on serving ethnic groups that are historically underrepresented in environmental/herpetological careers. The HERP

Project's goals were to: nurture participants' enthusiasm for field science and science-related careers, increase participants' knowledge of herpetology, and build confidence and competence in collecting, processing, analyzing and communicating scientific data. In order to accomplish these goals, The HERP Project had four interrelated threads. The Cyberhub thread was an Internet site designed to give The HERP Project a web presence allowing all citizens to interact with the Project on a real-time basis. The Celebrations thread sponsored community events that brought citizens with different expertise and interest levels together to promote better understanding of environmental issues and the ecology of reptiles and amphibians. The Studies thread engaged interested citizens of all ages and levels of expertise in meaningful herpetological research under the guidance of trained professionals. The HRE thread was the cornerstone of The HERP Project. HREs were designed to bring high school students together for extended periods of time to learn more about reptiles and amphibians. There were three HREs. The Eastern Piedmont HRE (pseudonym) operated on a university campus with significant input from faculty members and students and had substantial formal and informal educational components. The Central Piedmont HRE (HHC) and the Inner Coastal Plain HRE (SCR) mostly engaged in informal science/environmental education, as each program is offered at a church camp/outdoor retreat center. Both church camps provide significant acreage (362 acres at HHC, 486 acres at SCR) and have good populations of local amphibians and reptiles, collectively called herps. All three HREs occurred in the summer. Lumbee Indians constituted 33% of the SCR HRE participants in 2012.

Both FoK and CoPs can be characterized as highly contextualized (Hogg, 2011; Wenger, 1998). Studies in various fields have shown that a diversity of FoK may be leveraged in different contexts (Hogg, 2011). As an example, a Lumbee youth's hunting and fishing FoK would probably be of little help in a scientific laboratory setting. Additionally, Wenger (1998) wrote of a CoP's indigenous nature. Although a CoP may be influenced by outside forces, the community's reality is created by the CoP's resources and constraints. The CoP responds to these conditions, and the enterprise that results belongs to the CoP (Wenger, 1998). In this study, I report on the SCR HRE. The Eastern and Central Piedmont HREs developed within their own context, and thus the practices that constituted their joint enterprises were not identical to those reported here for the SCR HRE. Consequently, the FoK that were successfully leveraged by participants, and valued by CoP old-timers, would be unique to each HRE setting.

The Eastern Piedmont HRE was directed by Dr. W, a THG old-timer. This HRE occurred on a university campus. Unlike the other two HREs, the Eastern Piedmont HRE lasted four weeks instead of just one. The atmosphere was much like a university instructional setting: instruction was primarily formal in a classroom setting, but supplemented by a substantial outdoor component. Further, the students were exposed to several courses of study during the HRE, with herpetology being only one of the offerings. Participants were subject to the rules and regulations of the hosting university as well as those imposed by the HRE.

Similar to the Eastern Piedmont HRE, the HHC and SCR HREs were directed by Drs. A and N respectively. Both of these individuals were THG old-timers. However, in contrast to the Eastern Piedmont HRE, the HHC and SCR HREs were held at summer camps. Instruction was primarily out-of-doors and informal in nature, but supplemented by occasional classroom-type instruction. These latter two HREs were governed by camp rules and by edicts of the camp directors as well as by HRE rules. Further, the HHC and SCR HREs occurred in different physiographic provinces within North Carolina (Piedmont and Upper Coastal Plain respectively). This difference meant the participants and staff at the two HREs had to deal with different geographic settings, physiographic landscapes, plants and animals.

Some old-timers had the same role at all HREs, while other old-timers had different roles at different HREs. For example, Dr. N was a project director at HHC, but was HRE director at SCR. Mr. H was the frog-calling expert at all HREs. For all these reasons (and many more) the three HREs, while being administered by members of the THG CoP, were unique and distinct from one-another. The differences discussed above resulted in different norms and practices being valued among the three HREs. Thus, the FoK that participants were able to leverage to complement the norms and practices of the HRE were indigenous to the HRE they attended.

Sandhills Camp and Resort (SCR) Herpetological Research Experience (HRE)

SCR was located at the conjunction of Robeson, Hoke and Cumberland Counties, North Carolina. The site was located along a creek, which was impounded to form a lake that forms the camp’s northern border. HREs introduced students to ecological fieldwork about reptiles and amphibians. Participants were introduced to careers in ecology and herpetology, and the practices of scientists.

Selection of SCR HRE Participants

In order to create an equitable learning experience, the HREs recruited and accepted students from a diverse population of applicants. HRE personnel emphasized racial, cultural, economic, gender and age diversity when selecting participants from a primarily rural, low-income pool of North Carolina residents. They also wanted a mix of students who already had a deep appreciation for and more than a superficial knowledge of reptile and amphibians as well as students for whom this would be their first scientific exposure to the field of herpetology. The targeted participants for the SCR HRE were North Carolina rural students. Science achievement and participation gaps between North Carolina's urban (primarily affluent populations) and rural (predominantly low-income) areas demonstrate limited science outreach to rural citizens, many of whom are from non-dominant groups (Benavides, Ash, Huffling, & Matthews, 2013). Although SCR attendees came from at least two states, a majority came from rural Robeson and Cumberland Counties. Robeson County is primarily rural and is populated by nearly equal numbers of Lumbee Indians, African Americans, and Caucasians (Ross, 1993, 1999). An attempt was made to recruit equal numbers of males and females to the HRE. Demographics of the SCR participants are given in Table 4, and discussed at length below.

Using the applications of potential participants, faculty and staff collectively assessed the academic and scientific achievements of these applicants. This process not only determined which applicants to accept, but it also distinguished between 'novices' and 'experts.' A participant expert was defined as an individual with significant academic achievement or experience in herpetology in the judgment of faculty and staff. When the faculty and staff finalized participant groupings, they attempted to have at least one participant expert in each group. In past years, the HREs had been characterized by minimal minority presence (Tomasek & Matthews, 2009), but the minority presence at the 2012 SCR HRE was 66%, including six Lumbee Indian males and three Lumbee Indian females (33% of all participants) from Robeson County. My dissertation focuses on these Lumbee youths. The names that I used for all participants and SCR and HRE staff are pseudonyms.

Table 4

Ethnicity and Gender Demographics of All SCR HRE Participants for 2012 (*N* = 27)

Ethnicity/Gender	*n* (%)
White	
Male	8 (30)
Female	3 (11)
Total	11 (41)
American Indian	
Male	6 (22)
Female	3 (11)
Total	9 (33)
African American	
Male	0 (0)
Female	3 (11)
Total	3 (11)
Hispanic	
Male	1 (4)
Female	1 (4)
Total	2 (8)
Asian/Pacific Islander	
Male	1 (4)
Female	1 (4)
Total	2 (8)

Table 4

(Cont.)

Ethnicity/Gender	*n* (%)
Total Minority	
Male	8 (30)
Female	8 (30)
Total	16 (59)
All Ethnicities	
Male	16 (59)
Female	11 (41)
Total	27 (100)

Demographics of all SCR Participants

The demographics of the 2012 cohort of SCR HRE participants are presented in Table 4. A total of 27 participants attended the HRE; 16 (59%) were male and 11 (41%) were female. Eleven (41%) White participants represented the largest ethnic group at the HRE, 8 (30%) were male and 3 (11%) were female. There were 16 (60%) minority participants (American Indian, African American, Hispanic, Asian and Pacific Islander) of which 8 (30%) were male and 8 (30%) were female. Nine (33%) American Indians participated; 6 (22%) were male and 3 (11%) were female. Other ethnic groups were represented at lower frequencies.

The 27 participants were divided into five research groups in which they remained for the duration of the HRE. Ethnicity and grade level were the primary factors in determining group membership. Demographics of the five student groups are presented in Table 5. Groups 1, 2, and 3 were comprised primarily of rising ninth graders with one rising eighth grader and one rising tenth grader. Groups 4 and 5 were comprised primarily of rising tenth and eleventh graders with one rising twelfth grader. American Indians were distributed among the groups as follows: Group 1: two participants, two males; Group 2: three participants, two males, one female; Group 3: three participants, two males, one female; Group 4: one participant, female. All groups except Group 1 had a single participant who was presumed a priori to be an “expert.” Group 5 contained two novice hearing impaired male participants but no Lumbees.

Table 5

Ethnicity, Gender, and Other Significant Demographics of SCR HRE Participants by Group for 2012 (N = 27)

	Group				
Attributes	1	2	3	4	5
Ethnicity/Gender					
White					
Male	1	1		3	3
Female	1	1	1		
American Indian					
Male	2	2	2		
Female		1	1	1	
African American					
Male					
Female			1	1	1
Hispanic					
Male					1
Female					1
Asian/Pacific Islander					
Male			1		
Female	1				
Total	5	5	6	5	6

Table 5

(Cont.)

Attributes	Group				
	1	2	3	4	5
Other Attributes					
Grade Level					
Rising eighth	1				
Rising ninth	4	5	4		
Rising tenth			2	2	
Rising eleventh				3	5
Rising twelfth					1
Hearing Impaired Participants					2
Expert Participants	0	1	1	1	1

Lumbee SCR Participants

Demographics. As the Lumbee youths (Aaron and Barry; Dalton, Larry, and Sherry; Gavin, Harold, and Tonya; and Jewel) are the focus of my dissertation, I provide some data on the Lumbee participants' backgrounds. In Table 6, I present demographic information for these participants. Of the nine participants, six were male and three were female. Seven of the Lumbee youths reported that they lived in a rural location. The other two participants reported that they lived in a suburban area. Seven of the Lumbee youths were rising ninth graders, one was a rising tenth grader, and one was a rising 11th grader. Although the majority of these participants and their parents/guardians reported their household incomes as medium, two families reported their household incomes as low, and one family reported their household income as high.

Table 6

Demographic Information for the Lumbee Indian Youths

	Criterion[a]			
Participant	Sex	Rising Grade	Domicile Location	Income[b]
Aaron	Male	9	Rural	M
Barry	Male	9	Rural	L
Dalton	Male	9	Rural	M
Larry	Male	9	Rural	M
Sherry	Female	9	Rural	L
Gavin	Male	10	Suburban	M
Harold	Male	9	Rural	H
Tonya	Female	9	Rural	M
Jewel	Female	11	Suburban	M

[a] Data were self-reported by HRE participants and/or their parents or guardians. All data except Domicile Location were extracted from participants' applications. Domicile location data were extracted from the pre-survey (Appendix A).
[b] Income level: H=High-income household, M = Medium-income household, and L = Low-income household. Household income levels are based on 2010 U.S. Census data (Noss, 2012) that reported the real median household income in the United States to be $51,144. Thus, the household income classifications are Low ($0 to 24,999), Medium ($25,000 to 74, 999) and High (above $75,000).

I believe an important aspect of the participants' communities is the schools that they attend. Therefore, in Table 7, I present demographic characteristics of the schools attended by the Lumbee youths. As indicated by their self-reported domicile locations (see Table 6), most Lumbee participants considered themselves rural. The fact that they lived in rural areas is substantiated by the schools they attended (see Table 7).

Table 7

Demographic Characteristics of the Schools Attended by the Lumbee Indian Youths

	School Attended By					
	Aaron	Barry and Larry	Dalton and Harold	Tonya and Sherry	Gavin	Jewel
Student Criterion						
Rising Grade	9	9	9	9	10	12
School Criterion						
Grade Span	4 to 8	6 to 8	PK to 8	4 to 8	9 to 12	9 to 12
School locale code[a]	RF	TD	RD	RF	RF	TD
Title I School	Yes	Yes	Yes	Yes	Yes	Yes
Title I Schoolwide Prog.	Yes	Yes	Yes	Yes	Yes	Yes
Student/ teacher ratio	19.3	18.8	19.1	11.7	17.9	14.6
% Free/reduced-lunch	81	81	75	91	77	77
% Amer. Indian	25	85	94	57	83	33
% Asian/Pacific Islander	0	1.3	0	0	0.2	0.6
% Black	23	5.0	1.5	29	10	18
% Hispanic	12	4.8	0.5	6.7	1.9	15
% White	38	3	3	3	3	31
% Two or More Races	2.0	1.4	1.3	4.4	2.5	3

Note. Source: National Center for Educational Statistics, nces.ed.gov
[a] School locale code follows Schneider (2006). RF – Rural Fringe, RD – Rural Distant, TD – Town Distant

Based on locale codes reported by the National Center of Educational Statistics (Schneider, 2006), most Lumbee participants attended rural schools. Locale codes are derived from a classification system that describes a school's physical location along a scale that varies from large city to rural. These urban-centric locale codes are based on a school's physical proximity to an "urbanized area (a densely settled core with densely settled surrounding areas)" (Schneider, 2006, p. 1). The code system classifies territories into city, suburban, town, and rural. Towns and rural areas are further categorized by their distance from an urbanized area: fringe, distant or remote (Schneider, 2006). This system designates three of the schools attended by four of the participants as Rural:Fringe, which is a "census-defined rural territory that is less than or equal to five miles from an urbanized area, as well as a rural territory that is less than or equal to 2.5 miles from an urban cluster" (National Center for Education Statistics [NCES], n.d., New Urban-Centric Locale Codes section, para. 10). One school also has a rural designation, Rural:Distant. This designation places the school within a rural territory that is "more than five miles, but less than or equal to 25 miles from an urbanized area, as well as a rural territory that is more than 25 miles, but less than or equal to 10 miles from an urban cluster" (NCES, n.d., New Urban-Centric Locale Codes section, para. 11). The last two schools are designated as Town:Distant. These schools are in territories that are "inside an urban cluster that is more than 10 miles, and less than or equal to 35 miles from an urbanized area" (NCES, n.d., New Urban-Centric Locale Codes section, para. 7). By these measures, the majority (seven of nine) of Lumbee participants attended schools in rural areas.

Although seven of the nine Lumbee youths reported they were from households of medium income, the demographics of their schools provide a different economic picture of their communities (see Table 7). Title I, Part A of the Elementary and

Secondary Education Act (ESEA) allocates federal monies to local educational agencies (LEA) and schools that enroll a large percentage of children from low income families (U.S. Department of Education [USDE], n.d.). Qualifying LEAs and schools use these federal funds to help students meet state educational standards. LEAs allocate their Title I funds to schools with the highest percentage of low-income families. Schools in which at least 40% of the students come from low-income families may use Title I funds for Schoolwide Programs that benefit all students, not just those at risk of failing to meet state academic standards (USDE, n.d.). All Lumbee participants attended schools that had Title I Schoolwide Programs. Another characteristic that revealed the economic status of the Lumbee participants' communities was the percentages of students receiving free or reduced-price lunch at their schools (see Table 7). These percentages ranged from 75% to 91%.

It is also interesting to note that seven of the nine Lumbee participants attended schools where American Indian students comprise from 51 to 94% of the student body. In contrast, the percentage of American Indians attending public elementary or secondary schools in the United States is less than one percent (NCES, 2015). Two schools attended by Lumbee participants differed demographically from the other four: Jewel's school's demographics did not reflect the demographics of her community, as she attended an early college at a local community college. Aaron's school was in a community outside of a town that is not located in the county's most concentrated American Indian population center.

Portraits of Lumbee participants. Below I present brief portraits of each Lumbee participant. These portraits are organized by the HRE groups in which they were placed. I used three sources of HRE application information for the portraits: participant demographic information from their applications, letters of recommendation written by others, and participant essays on why they wished to attend the HRE.

Lumbee participants in Group 1: Aaron and Barry. The two Lumbee participants in Group 1 were rising ninth-grade males: (Aaron and Barry). The two female members of Group 1 were also rising ninth graders: Judith (Asian/Pacific Islander) and Bonnie (White). Cole (White), the third male in the group, was a rising eighth grader. None of this group's participants were experts (see Tables 4 and 5).

Aaron's family had a medium income, and Barry's family income was low. Both Barry and Aaron lived in rural areas (see Table 6), and they attended the eighth grade in different rural schools. Aaron's school housed grades 4 to 8 while Barry's school was a more traditional middle school housing grades 6 to 8. Both schools had a high percentage (81%) of students who qualified for free or reduced-price lunch. The student body at Barry's school was 85% American Indian, and the student body of Aaron's school was 25% American Indian (see Table 7). Although the percentage of American Indians attending Aaron's school was the lowest for any school attended by a Lumbee participant, it is still much larger than the 1% national average (NCES, 2015).

Aaron's career and technical education teacher wrote his letter of recommendation. She described him as smart, hard-working, a go-getter with a positive attitude, and pleasant to be around. She believed that "[h]e will go far in life because of these traits." Aaron was a member of the Native American Student Association (NASA). In his essay, Aaron wrote that he watched Animal Planet and Discovery Channel every day, and that he knew about some reptiles. He wanted to know more about reptiles and amphibians, and "to learn about their habitats and their food and life cycles." In addition, he wrote that all the HRE topics and activities seemed really interesting and fun. Finally, he wrote that he was "very easy to get along with and eager to learn."

Barry did not submit a student essay or letter of recommendation. Therefore, I can only present a very brief portrait of Barry based on the information his mother gave in his application. Like Aaron, Barry attended the NASA club at his school. Barry had also learned to do bead work through the Cultural Academy, which is administrated by the Indian Education Program of the Public Schools of Robeson County. Responding to the following item on the HRE application: "In order to best meet the needs of all participants, please describe any special needs that your child has.", Barry's mother wrote "Need [sic] Extra help in Reading and science."

Lumbee participants in Group 2: Dalton, Larry, and Sherry. The three Lumbee participants in Group 2 were rising ninth graders: Dalton, Larry, and Sherry. Additionally, there were two non-Lumbee members of the group who were also rising ninth graders: Erin, a White female, and Chandler, a White male. Chandler was the group's expert participant (see Table 5).

Dalton and Larry's families had medium incomes and Sherry's family had low income. Dalton, Larry and Sherry all lived in rural areas (see Table 6). These three Lumbee participants attended the eighth grade in separate rural schools (see Table 7).

Larry attended the same school as Barry from Group 1. These three schools exhibited the following percentages of students receiving free or reduced-price lunch: 75%, 81%, and 91%. Another commonality among the three schools attended by Group 2 participants was that the majority of the students enrolled at each school were American Indian (see Table 7). The school that Dalton attended houses pre-kindergarten through the eighth grade classes, and its student body was 94% American Indian. Larry's school had a student body that was 85% American Indian. Sherry's school spanned grades four through eight, and the student body was 57% American Indian.

Dalton's eighth grade math teacher described Dalton as an honor student with a remarkable academic performance. According to his teacher, Dalton's academic achievement was not due to his intelligence alone. Dalton had a strong work ethic; he was hardworking and persevered in his studies. In addition to his academic ability, Dalton had excellent social skills; his teacher wrote that he was dependable and worked well as a team member. I learned from Dalton's application that his school recognized his academic achievements by inducting him into the Junior Beta Club. Dalton was active in his church, and volunteered to "cut grass for widows in the community." In his essay, Dalton wrote that he loved the outdoors and observing reptiles and amphibians in their habitat. Dalton also wrote that he hoped that during the HRE he would learn more about herpetology and "the accepted ways" to collect, process, and analyze data. Finally, Dalton wrote that he hoped to continue his study of herpetology after the HRE.

Larry's letter of recommendation was written by someone from his church community. She wrote that Larry lived and worked on a farm, and that he loved the outdoors and all animals. Larry is active in his church and plays softball there. In his student essay, Larry echoed what the church member wrote. Larry lived on a farm near the Lumber River where, he wrote, he would be able to further his study of herpetology after the HRE. Also, there was a major canal (a large drainage ditch) near his farm where Larry could continue his studies. He wrote, “I would love to hunt and examine turtles, frogs, and snakes. This has always been interesting to me.”

Sherry’s eighth grade English Language Arts teacher described her as an excellent student in all subjects, including science. Her teacher further described Sherry as “an animal lover who loves to smile.” She played volleyball at school. Her mother filled out the application, and wrote that Sherry was considering a career in the veterinary field. Her mother said that “Sherry is outgoing, and likes making new friends.” In her essay, Sherry wrote that she loved meeting new people, learning, and engaging in hands-on activities that deal with nature. Sherry dreamed of becoming a veterinarian, and hoped that her experience at the HRE would provide insights into her chosen career. Sherry described herself as “very outgoing, and not afraid to try new things.”

Lumbee participants in Group 3: Gavin, Harold and Tonya. Gavin, Harold and Tonya were the Lumbee participants in Group 3. Gavin was going into the tenth grade the following year; both Tonya and Harold were going into the ninth grade (see Table 5). Non-Lumbee members of Group 3 were Daisy, Tinesha and Nicholas. Daisy (White, female) and Tinesha (African American, female) were rising ninth graders. Nicholas (Asian/Pacific Islander), the group’s expert participant, was going into the tenth grade the following fall. Tonya and Harold self-reported that they lived in rural areas, but Gavin identified his community as suburban. Tonya and Gavin were from families of medium income, but Harold was from the only Lumbee family that reported a high income (see Table 6). During the year previous to the HRE, Tonya was in the eighth grade at the same rural school (grades 4–8) as Sherry, and Harold attended the same rural school (PK–8) as Dalton. Gavin was a ninth grader in a high school. Although Gavin reported that he lived in a suburban area (see Table 6), his school's locale code clearly placed his high school in a rural area (see Table 7). Both Tonya's and Larry's schools have high percentages of students who qualify for free or reduced-price lunch. Seventy-seven percent of the students at Gavin's high school qualify for free or reduced-price lunches. As reported previously, Harold's school's student body is 94% American Indian, and 57% of the students at Tonya's school are American Indian.

Tonya's Career and Technical Education teacher wrote that she was an academically and emotionally mature individual who was ready to participate in a summer enrichment program like the HRE. Her teacher reported that Tonya's grades were consistently above average, and that Tonya participated in numerous extracurricular activities. Additionally, her teacher wrote, "Tonya is bright, energetic, compassionate, and genuinely well rounded . . . [and] would be an asset to your program." Tonya's application revealed that she did participate in numerous school activities: Beta Club, NASA, AISES (American Indian Science and Engineering Society), Battle of Books, volleyball, softball, basketball and cheerleading. Tonya typed her essay in a font (appropriately named Curlz MT) that was full of curlicues. She wrote that the HRE's subtitle "Turtles and Frogs and Friends," inspired her to apply to the HRE. She added "I am a County Girl, born and breed [sic]." She wrote that nothing suited her better than to be outdoors and she loved turtles. Although turtles were her favorite herp, Tonya wrote "I can deal with the frogs, but I am a little 'iffy' when it comes to other friends such as snakes." She was, however, willing to "compromise, that is the country in me. :)." Tonya believed that she had a very outgoing personality, and she was willing to do just about anything to have fun. Finally, Tonya wrote: "I enjoy learning about science, and hope to one day peruse [sic] a career that is science related."

Gavin's ninth grade Physical Science teacher wrote that Gavin was on the A and B honor roll, but that Gavin worked hard to perform at this above average level. Gavin had earned his B+ average in Physical Science because of his "hard work and dedication to his grades and coursework." With little assistance, Gavin was able to research and develop his own conclusions to a problem. Gavin planned to pursue Veterinary Science at North Carolina State University. Gavin's teacher felt that his success extended beyond his academics: Gavin participated in his school's NASA and AISES organizations. Gavin's teacher concluded: "Gavin is respectful, well-mannered, and has the skills to communicate and work with his peers. In my view, he is an excellent student." Gavin's father completed the application. His father wrote that Gavin had attended summer programs at the local regional university. Gavin's father also wrote, "My son is extremely interested in reptiles especially box turtles. He is very excited about the opportunity to attend this program." In his essay, Gavin revealed his interest in box turtles. Gavin further indicated that he already knew how to sex and age box turtles, but that he wished to learn more. In addition, Gavin felt that the HRE experience would help him enjoy science, and would help him become more involved in his AISES organization. Gavin wrote “I believe science is an important part of our world, and I am excited about this opportunity.” As well as wanting to know more about science in general, Gavin also hoped to learn more about box turtles specifically: “I am also very excited about the opportunity to study and monitor the box turtle populations in Robeson County.” Gavin indicated that he had access to land “along some of the swamps” where he knew that box turtles lived. He expressed interest in monitoring box turtles along the Lumber River.

Harold’s eighth grade English Language Arts teacher wrote his letter of recommendation. Harold attended the same school as Dalton, and his letter of recommendation is similar to Dalton’s letter. Both Dalton’s and Harold’s teachers refer to their work ethic and excellent social skills. Harold was dependable, had a great personality, and had the ability to work well in a group. Harold’s teacher also wrote the he had “a variety of interests, including a passion for animal life and designing his own artistic creations.” From Harold’s application, I learned that he was involved in his church, and that he participated in their tailgate ministries during the local university’s football games. In his essay, Harold wrote about his family’s 225 acre farm where he and his family have “see[n] and experience[d] all kind [sic] of wildlife [t]here, which include deer, foxes, bobcats, rabbits, flying squirrels, and a whole host of others. Of course, we have lots of snakes, lizards, turtles and frogs also.” He wrote that although he had many passions and interests, animals had always been a big part of his life: “I have always been interested in all kinds of animals, especially reptiles and amphibians. I love learning about them and their environments." Harold felt that the HRE would provide the opportunity for him to "learn more and to explore all aspects of these animals." Harold closed his essay by writing that his farm would be "the perfect place to monitor reptile and amphibian populations."

Lumbee participant in Group 4: Jewel. Jewel, a rising 11th grader, was the single Lumbee participant in Group 4. Zinetta (African American), a rising tenth grader, was the other female in Group 4. The three males in the group were all White: Thomas, Roger and Carter. Thomas and Carter were rising 11th graders, but Roger was a rising tenth grader (see Table 5).

Jewel believed that her medium income family lived in a suburban area (see Table 6). Jewel attended tenth grade at an early college (grades 9 to 12) supported by a local community college. Jewel's early college, similar to the other schools, had a high percentage (77%) of students who qualified for free or reduced-price lunch. The percentage of American Indians (33%) that attended the early college is the lowest percentage of any school, except for Aaron's school. However, the racial demographics of this early college reflect the demographics of the Robeson County where it is located (U.S. Census Bureau, 2015).

Jewel's early college biology teacher wrote her letter of recommendation. Her teacher wrote that Jewel knew the importance of an education, but she was quiet. Jewel only talked when spoken to. Jewel did what was expected of her and responded positively to authority figures. Her biology teacher thought that Jewel did well in science and science projects when she received proper instruction. Jewel would be successful during a rigorous summer science experience if she was not required to speak in public. Jewel's teacher felt she was an above average student capable of attending a four-year university and developing into a successful citizen. Her teacher hoped that Jewel's attendance at the HRE would "allow her the experience to overcome her shyness to become confident and build self-esteem." Jewel's application might belie her teacher's portrayal of a somewhat withdrawn student. Jewel revealed that she had been treasurer for her school's NASA organization, been a member of the Go-Green Club, and had been a participant in her school's Relay-for-Life activity for two years. Jewel also volunteered at a local, rural elementary school with the following characteristics: a student body that was 90% American Indian, had a Title 1 Schoolwide Program, 99.6% of the student body was eligible for free or reduced-price lunch (NCES, n.d.). Jewel's mother wrote her application, and wrote the following about Jewel:

> My daughter is persuing [sic] a career that is greatly involing [sic] science. I think that her going to your camp it will help in the long run with her career choice. She is very interesting [sic] in everything there is to do with Science and the studies of animals of all sortes [sic].

Jewel titled her handwritten essay "About Me;" she placed a smiley face at the end of her title. Jewel wanted to attend the HRE because she had an "unexplained strange LOVE for studying reptiles and amphibians." Jewel hoped that attending the HRE would further her longtime goal of working with reptiles and amphibians. In the future, Jewel hoped to go "overseas and study the different species of reptiles and amphibians." Jewel concluded her essay with her suggestions for the proper places to monitor reptiles and amphibians. For reptiles, she suggested wooded areas and abandoned buildings. Jewel correctly suggested that certain types of amphibians would be found in moist areas. However, Jewel incorrectly stated that amphibians might be found in these areas as “amphibian animals breathe [sic] with their lungs with their moisten [sic] skin!”

Daily Schedule for SCR HRE, 2012

The five HRE activities undertaken at SCR are discussed briefly below. Most of the information presented has been gleaned from the HRE research activity section of The HERP Project Cyberhub (The HERP Project, 2012).

Aquatic amphibian research. This project was designed to familiarize participants with the trapping methods, measurements, identification and diversity of aquatic amphibians. Further, an effort was made to determine what kind of bait was most effective in attracting these animals. This activity was centered on the creek and two of its small tributaries. Minnow traps were utilized and were baited with chicken parts, or glow sticks, with no-bait/no-light traps as a control. Participant groups would check the traps each day and record the kinds and numbers of animals captured in the traps. Animals captured included: Two-Toed Amphiumas (a strange aquatic salamander unique to southeastern coastal swamps), frogs, insect larvae and small fish. Live bait seemed most effective in attracting Amphiumas, but other organisms showed no bait preference.

Aquatic turtle study. This project was designed to show participants how to trap, measure, mark and identify aquatic turtles. Mark-recapture theory was discussed during this exercise. Aquatic turtle traps were set in the creek and a major side channel of the creek. Aquatic turtle hoop traps and basking traps were the methods of capture.

Students identified turtle species using field guides. Species found were: Yellowbelly Sliders, Snapping Turtles and Spotted Turtles. Calipers were used to measure shell dimensions; spring balances were used to weigh turtles; and animals were sexed. Participants counted scutes, photographed carapaces and plastrons, and recorded atmospheric and water temperature data. Marginal scutes were marked with a triangular file in order to facilitate future individual aquatic turtle identification.

Box Turtle study. This study exposed participants to the use of Boykin Spaniel hunting dogs in finding Box Turtles and the measurement and marking of Box Turtles. The Boykin Spaniel dogs had been trained to find and retrieve Box Turtles to their handler. Calipers were used to measure shell dimensions. The animals were sexed, weighed using spring and/or platform field balances and marked individually before release. The marking technique was the same as that used for aquatic turtles.

Lizard study. Participants were familiarized with species of coastal plain lizards, capture techniques and behavior patterns, and recorded their findings. Species found at SCR included Carolina Anoles, Eastern Fence Lizards, Five-line Skinks, Broadhead Skinks, Southeastern Five-line Skinks, and Six-Lined Racerunners. Capturing lizards with lassos was a point of emphasis. Participants constructed their own lizard lassos and then used them to capture lizards in and around camp buildings. Captured lizards were identified to species using field guides, then sexed, weighed and measured using rulers. Captured animals were marked with a permanent marker and released within 24 hours at the point of capture. Seven Carolina Anoles were purchased and kept in terraria for the purposes of behavioral studies.

Snake study. This activity had both outdoor and indoor components. Participants actively searched for snakes by walking trails and turning over downed logs in the woods. Drift fences and pitfall traps at the ends of drift fences were also inspected for snakes. Plywood and tin cover board transects provided cover for snakes and were inspected daily. After participants captured snakes by hand or in the various traps, they identified the snakes to species and measured the lengths of the snakes using three different techniques: squeeze box, snake tubes, and the "along the wall" method. The indoor experience also gave participants experience in the handling and behavior of snakes. The proper handling of snakes was a point of emphasis.

Calling amphibian survey protocol (CASP). In this evening whole-group study, participants learned to identify species-specific frog calling patterns. The kinds and relative abundances of various frog species are determined by assessing the number and frequency of their calls. Data on environmental conditions are collected at the time of survey. Participants recorded data based on a protocol modified from that outlined in the North Carolina Calling Amphibian Survey Project (NC Partners in Amphibian & Reptile Conservation [NCPARC], 2012). In our HREs, beginning 30 minutes after sunset, participants spent two minutes at each of five stops along a designated route. During the stop time, students listened for frogs. At the end of the listening period, students discussed which frogs they heard and then determined an index of abundance: Level I – Individuals can be counted and there is space between their calls, Level II – Some overlapping calls, but some individuals can be distinguished, or Level III – Full chorus, calls constant, continuous, and overlapping. At this level of calling, individual frogs or frog calls cannot be identified. The auditory sensation is that of a continuous, ongoing symphony of frog vocalization.

Morning group stories. Just after morning herp studies, and just before lunch each day, each group would recount their experiences from the morning's studies, emphasizing any unusual events, and would exhibit interesting or unusual animals that they had caught.

Electives. Electives were offered on Sunday afternoon, and Tuesday and Thursday evenings. The HRE participants could choose among electives including night hikes, jewelry making, model magic art, geocaching, snake dissection, art, lizard lassoing, tardigrade microscopy, and radio telemetry turtle tracking. Other educational researchers and I observed select Lumbee youths engaging in the electives that they chose.

Conceptual Framework

Maxwell (2005) characterized a conceptual framework as primarily a conception or model of what is out there that you plan to study, and of what is going on with those things and why—a tentative *theory* of the phenomena that you are investigating. The function of this theory is to inform the rest of your design—to help you to assess and refine your goals, develop realistic and relevant research questions, select appropriate methods, and identify potential validity threats to your conclusions (pp. 33–34). Conceptual frameworks guide the research design of a study and also provide a method of validating procedures and results against the concepts being tested (Maxwell, 2005).

Conceptual frameworks can be constructed using four basic sources of information (Maxwell, 2005). These sources include: experiential knowledge, existing theory and research, pilot and exploratory research, and thought experiments. I employed all of these sources in constructing the conceptual framework for my dissertation, and I discuss them briefly below.

Experiential Knowledge

When I started my graduate work at UNCG, I immediately became involved with the herpetology summer experiences. My six years of experience at these HREs has given me great insight into their function and affordances. Further, I have taught Lumbee students since 1989, so I am familiar with their culture and communities. I feel that my experiential knowledge played an important part in the development of my conceptual framework, because "[s]eparating your research from other aspects of your life cuts you off from a major source of insights, hypotheses, and validity checks" (Maxwell, 2005, p. 38).

Existing Theory and Research

Subsequent to the 2010 HRE (the first attended by Lumbee youths), I became aware of existing theory that began to illuminate my observations of the integration of Lumbee youths into the CoP (Maxwell, 2005). I speculated that these continuing HREs could be modeled as a CoP. Further, I conceived that the Lumbee youths brought knowledge from their rural backgrounds that afforded them integration into, and the ability to make contributions to this HRE (Ash et al., 2015).

Maxwell (2005) states that another use of prior research is to discover research methods appropriate to one's own research. While my introduction to FoK literature came relatively late in my synthesis of a conceptual framework, my examination of FoK literature revealed that ethnography was an appropriate research method for this study (Basu & Calabrese Barton, 2007; González & Moll, 2002; Moje et al., 2004; Moll & Greenberg, 1990; Moll et al., 1992; Vélez-Ibáñez, 1988).

Pilot and Exploratory Research

As I began to explore the practices of the Lumbee males at the 2010 HRE, I became increasingly convinced that this HRE functioned as a community of practice (Lave, 1991; Lave & Wenger, 1991; Wenger, 1998). I piloted this construct in a paper (Ash et al., 2015) for a graduate class, *Socio-cultural perspectives in mathematics and science education*.

Thought Experiments

Thought experiments "challenge you to come up with plausible explanations for your and others' observations, and to think about how to support or disprove these" (Maxwell, 2005, p. 59). During The HERP Project human research team meetings and subsequent graduate coursework *Critical perspectives of science education and informal learning environments* and *Doctoral seminar in learning and cognition*, I was challenged to provide additional plausible explanations for my observations, and defenses of my theoretical approach. My exploratory research and thought experiments have given me confidence that my conceptual framework is sound.

Formulation of a Conceptual Framework

Synthesizing information gleaned from the various activities described above, I developed a conceptual framework drawing from both CoP and FoK that elucidated the interactions of Lumbee youths at the SCR HRE. The concept of practice is central to both bodies of theory, and provided a link by which I could connect them in order to explain my results.

I speculated that these continuing HREs could be modeled as CoPs with mutual engagement (shared practices), joint enterprise and shared repertoire (Lave, 1991; Lave & Wenger, 1991; Wenger, 1998). Further, I conceived that FoK theory (Moll et al., 1992) would be a good way to characterize the practices that allowed these Lumbee youths LPP at the SCR HRE.

Research Procedures

General

I used a mixed methods ethnographically inspired design to inform my data acquisition and analysis, and present my findings as a case study involving a single case (Creswell, 2007). Further, the design was embedded, as the qualitative data comprised the primary data strand, while the supplementary quantitative data strand was used to provide a more narrow view of each individual participant. The development of emergent themes from qualitative data denoted a constructivist perspective, while the quantitative data required that I work from postpositive assumptions (Creswell & Plano Clark, 2011). However, the integration of the findings from both strands reflected a pragmatic orientation (Creswell & Plano Clark, 2011).

Protocols

UNCG science education faculty and science education doctoral students developed a set of data collection protocols that documented the activities and progress of the Lumbee youths in several ways. The HRE began Sunday, July 15, 2012, and ended on Friday, July 20, 2012. Sunday afternoon, all participants were given a pre-test concerning their knowledge of herpetological and environmental issues and also a pre-survey of science attitudes, interests, and experiences. On Thursday afternoon, all participants were given the same test as a post-test and also a revised post-survey of science attitudes, interests, and experiences. After the participants finished their post-tests and surveys, they completed individual exit interviews with HRE faculty and staff. These interviews lasted approximately 20 to 30 minutes each.

These instruments provided both qualitative and quantitative data about the Lumbee youths and their interactions in the HRE CoP. Further, Lumbee youths (with a single exception) were all placed in groups 1, 2, or 3. Trained educational researchers associated with these groups took field notes, audio recordings, and videos of all participants as they cycled through the five field activities, and evening activities and electives provided by the HRE.

Every morning (Monday to Friday) each participant research group engaged in one of the five herpetological activities. These activities were: snakes, lizards, aquatic turtles, aquatic amphibians, and box turtles. Since there were five groups of participants, and each group participated in a different activity each morning, by Friday, each group had participated in every activity.

Mixed Methods Data Collection Procedures

The demographics of the HRE (Tables 3, 4) and the times of administration of pre- and post-tests and exit interviews have been discussed above (see Appendix D). Information concerning the Lumbee youths (six boys, three girls) gleaned from these instruments, as well as observations of their activities (audio and video recorded) comprised the database for my dissertation.

Qualitative data. I helped develop a semi-structured interview protocol (see Appendix E) in conjunction with UNCG science education faculty and graduate students. Interviewers received training in interview protocols approved by UNCG faculty. The interviews were audiotaped and transcribed according to protocol. In addition, trained observers monitored participants as they engaged in HRE activities. Field notes, tape recordings, and digital videos were taken of activities involving Lumbee youths when observers were present. This information was transcribed, coded and analyzed to reveal themes about the Lumbee youths' participation in the HRE (Creswell, 2007).

Quantitative data. HRE pre- and post-tests of herpetological knowledge (Appendix A) were given to all participants according to the schedule discussed previously. Pre- and post-surveys of science attitudes, interests and experiences (se Appendices B and C) were also administered to students. The literature suggests that assessing attitudes as well as knowledge is a critical component of informal science education (Falk, 2008).

Data Analysis

Using a mixed methods ethnographically inspired design with a single case, qualitative and quantitative data were collected concurrently during the HRE. These data were used to make three types of inferences: qualitative, quantitative, and meta-inferences that combine information from the two categories (Creswell & Plano Clark, 2011).

Qualitative data preparation and analysis. Qualitative data types were prepared in different ways. Handwritten field notes were typed into Microsoft (MS) Word documents, and interviews in audio files were also transcribed into MS Word documents and uploaded to The HERP Project file server. All other digital audio files and videos were compressed and uploaded to the same server. As a fair amount of time passed between the collection of the qualitative data and my analysis of it, I felt that it was important for me to re-immerse myself in the culture of the HRE. I downloaded the audio and video files for the 2012 SCR HRE from the server, and I watched every video and listened to every audio for the HRE. I also read all the participants' interviews, all field notes, and all contact summary sheets. For the Lumbee participants, I read all their application materials and I re-transcribed their interviews because I felt that the professional transcription was inadequate. In my estimation, I considered a total of 565 files of the following types and numbers: video files (472), audio files (14), contact summary sheets (16), field notes (11), interviews (27), application files (9), application essays (8), and letters of recommendation (8). I transcribed any video or audio files that I considered pertinent to my dissertation using InqScribe (InqScribe software), and converted these files to MS Word documents. I chose to use InqScibe as my transcription software as Dedoose charges for storing video files. Transcribing my video files into MS Word documents helped me to avoid these charges. I also converted any PDF files (application materials) to MS Word documents. All other transcribed materials were already in MS Word format. At this point, I considered 348 files (62% of all files I examined) useful to my research, and all files were in MS Word format. I uploaded these files to Dedoose for analysis.

Using Dedoose, files were excerpted, blocked, labeled and coded. Application materials were processed first. For HRE materials, I processed the files in Dedoose in the following order: I processed all files by day in sequential order. Within days, I coded by group as a first level of organization, and by time of day as a second level. After I coded each group's morning studies, I then coded whole-group activities such as group story time and evening electives. I coded other researchers' daily contact summary sheets and field notes last. Finally, I coded the participant interviews. I created memos that helped me develop codes and themes using open and axial coding (Corbin & Strauss, 2014). Emerging themes were sought that helped describe participants' FoK brought to the HRE, and that explained their abilities to function in the HRE CoP.

The FoK of the Lumbee Indians were discussed in detail in Chapter III. It is my belief that this tribe has a distinctive rural history and culture. The evidences that I coded during data exploration included any signs of their strong attachment to the land, signs of rural life practices or pastimes such as hunting and fishing, and signs of experience with wildlife that allowed their contributions to the SCR HRE.

I analyzed the SCR HRE data to search for other FoK themes derived from a rural lifestyle that allowed the Lumbee youths to integrate into the practices of the SCR CoP. This integration would allow them to both contribute to and benefit from the CoP. My qualitative findings are reported and discussed in Chapter V.

Quantitative data analysis. I analyzed quantitative data for pre- and post-test scores by one-way analysis of variance (ANOVA) using Minitab statistical software (Minitab, 2010). I set an alpha less than 0.05 to determine significant differences in pre- and post-test scores (Howell, 2010).

I assessed pre-test data for differences in the prior science/herpetological knowledge of all twenty-seven participants in relation to: gender, ethnicity, domicile location, income level, public school grade level. In order to document the rural domicile location of Lumbees, I compared the distribution of Lumbee domicile location (rural vs. urban + suburban) with the distribution of domicile location of non-Lumbee participants using Fisher's exact test (Howell, 2010). For Lumbee participants only, I analyzed pre- vs. post-test scores to assess increments in herpetological and scientific understanding over the course of the HRE using one-way ANOVA.

I analyzed pre- and post-survey responses by looking at the distributions of the various responses which were unique to each question (e.g., "yes" vs. "no"; strongly agree to strongly disagree with five intervals) among the Lumbee participants. For all survey questions, the distribution of responses included only nine observations. Due to these small sample sizes (with high potential for non-normality), and because the median always occupies the 50th percentile of a distribution (Howell, 2010), I chose the median as the preferred indicator of central tendency when examining pre- and post-survey data. Since pre- and post-survey forms differed in the phrasing and sequencing of questions, I assessed these instruments independently with no attempt at direct comparison, with the exception of nine pairs of items that I thought were similar enough to be compared directly.

Potential Ethical Issues

The usual ethical concerns (seeking informed consent and assent, maintaining confidentiality of data and records, and protecting anonymity of individuals) were addressed when The HERP Project proposal was reviewed by the Institutional Review Board for Research on Human Subjects at UNC Greensboro (Creswell, 2007).

As the participants in my study are American Indians, I needed to reduce the racial and/or ethnic bias in the language I used in my study. American Indian and Native American are accepted ways of referring to North America's Indigenous People. But as there are close to 450 groups of Native Americans, I use the term "Lumbee Indian" to indicate this group's tribal identity (American Psychological Association, 2007). In my speech or writing, I make no statements, nor do I develop themes that typecast Lumbee individuals, or trivialize Lumbee culture. By following these guidelines, I attempted to avoid stereotyping the participants (Bell et al., 2009). With respect to this issue, and other possible ethical concerns associated with the Lumbee Tribe, Dr. Velinda Woriax, a Lumbee Indian and member of the biology department at UNC Pembroke, has acted as a gatekeeper and key informant as well as an external member of my doctoral committee.

Validity

Educational research requires that the validity of the data be assured insofar as possible by the researcher. The quality of data, results and interpretations must be assured before the research can be formally presented.

As my dissertation involved a mixed methods protocol, I define validity for both types of data, as the meaning is different for each. Qualitative validity "comes from the analysis procedures of the researcher, based on information gleaned while visiting with participants, and from external reviewers" (Creswell & Plano Clark, 2011, p. 211). Safeguards must be taken to ensure that the qualitative data collected is as accurate as possible. Of the several options that Creswell and Plano Clark (2011) present, I felt that triangulation was my best option. My qualitative data sources were varied: videos, audio files, interviews, and field notes. Additionally, data were collected by several individuals. Thus, I was able to triangulate among data types and individuals. This allowed me to develop evidence for codes from several sources and individuals. As another validation approach, I had peers examine my data once they were coded.

Quantitative validity requires that the measurements or scores produced by the research are, in fact, indicative and supportive of the specific items being studied (Creswell & Plano Clark, 2011). These specific items, in turn, must support the conceptual framework proposed by the author. In my case, the pre- and post-tests had evolved over several years of use and were vetted by peers and advisors for their validity as instruments. I was allowed to add questions to pre- and post-surveys that had not been previously used at other HREs. Consequently, the survey had been modified to my specific research needs, as well as the general needs of The HERP Project.

Finally, I have been associated with the HREs and THG for six years. Thus, I have spent prolonged time in the field (Creswell, 2003). I participated in, and am thoroughly familiar with the protocols and procedures that occurred during all HRE activities. I was able to ensure the validity of these procedures. Further, I am very familiar with the other individuals who collected both qualitative and quantitative data. This afforded me confidence that all data collection was conducted in a professional and uniform manner. I ensured that the data collected were sufficient to produce thick, rich descriptions of each Lumbee participant (Creswell, 2003).

Summary

In this chapter, I discussed the methodological concepts and practices of this dissertation. I described the setting and site of the SCR HRE, and characterized the selection and demography of the HRE participants. In addition, I presented my conceptual framework and my research procedures including data collection, processing, and analysis. Finally, I addressed ethical and validity concerns pertinent to the dissertation. In Chapter V, I present the results of my qualitative research. In Chapter VI, I present the results of my quantitative research and in Chapter VII I discuss my meta-inferences and discuss implications of my findings.

CHAPTER V

RESULTS AND DISCUSSION: QUALITATIVE DATA

Introduction

Based on my review of the literature and my theoretical constructs, I developed the following research questions concerning the Lumbee youths at the SCR CoP:

1. What FoK did these Lumbee youths bring to the SCR CoP? *(FoK)*
2. How did these Lumbee youths come to have these FoK? *(Source)*
3. How did these Lumbee youths leverage their FoK? (*Leverage*)
4. How did these Lumbee youths contribute to the SCR CoP? *(Contributions)*
5. How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? *(Benefits)*

In order to answer my research questions, I utilized a mixed methods design involving both qualitative and quantitative data. In this chapter, I report and discuss qualitative results and conclusions. I will present my quantitative results and conclusions in Chapter VI. I organized the analysis of the qualitative data for Lumbee participants collected during the HRE in the following way:

1. As the HRE experience was a group endeavor, I chose to assess the participants' HRE contributions as members of a small research group. In this way, I could highlight their contributions to CoP functions.

2. I followed each group through time so that I could document changes in participant contributions and engagement.
3. Finally, I looked at individual Lumbee participants' characteristics and contributions to the HRE.

An exception to this process of small group analysis was Jewel, who was the only Lumbee participant in a small group with no other Lumbee participants. As Jewel was first mentioned by educational researchers while she was engaged in elective activities with Aaron and Barry (members of Group 1) on Sunday afternoon, I included Jewel in my analysis of Group 1.

Development of Codes and Themes

I present my conception of the relationship of important themes and subthemes in Table 8. My rationale for the development of these relationships follows. I utilized 348 Microsoft (MS) Word files as the database for my qualitative coding. As a first effort at developing open codes (Corbin & Strauss, 2014) for so many files, I utilized Hogg's (2011) Foundational Definitions of Funds of Knowledge (Hogg, 2011, Table 1). Hogg presented three historical definitions of FoK:

1. "Households must manipulate (several funds) for subsistence and development . . . each of these . . . entails a broader set of activities which require specific knowledge of strategic importance to households. These bodies of knowledge are what we call Funds of Knowledge" (Moll & Greenberg, 1990, pp. 322–323).

2. "[H]istorically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and wellbeing" (Moll et al., 1992, p. 134).

3. "Funds of knowledge is based on a simple premise . . . that people are competent and have knowledge, and their life experiences have gotten them that knowledge" (Gonzalez & Moll, 2002, p. 625).

Hogg lists a variety of sources of FoK (Hogg, 2011, Table 2). I used these sources of FoK as another initial set of open codes: culture, family, community, peers, popular culture, and life experiences. Hogg discusses the various groups of individuals who might possess FoK to be researched (Hogg, 2011, Table 3). Such groups of individuals might include household members, teachers, parents and other adults in the community, or students. I also considered these groups when developing my initial open codes.

Table 8

Themes and Subthemes

1. Ways of being a community member a. Being a good group member b. Being a community science learner c. Being talented
2. Ways of knowing about science or natural history a. Place-based knowledge or skills b. Knowledge learned through informal science education c. Knowledge learned through popular culture
3. Being a Lumbee a. Responding to stereotyping or discrimination b. Responding to misinterpretation of Lumbee English

Note. Numbers denote themes and letters denote subthemes.

Using all the information gleaned from Hogg (2011), I proceeded to develop a rationale for my initial open codes. Using Dedoose software, I excerpted all text that I felt represented FoK. I coded by participant, definitions of FoK, sources of FoK, and whose FoK (household members, teachers, students, parents, and other adults in the community). Once preliminary coding was complete, I determined that Hogg's definition number one above had never been used as a code. I coded for the second definition ten times and the third definition 63 times. I realized that what I was looking for was the attributes of the Lumbee participants that allowed them LPP in the social and scientific practices of the SCR CoP. Therefore it was unnecessary to analyze the category "whose funds of knowledge." Wenger (1998) defined knowledge as "a matter of competence with respect to valued enterprises—such as singing in tune, discovering scientific facts, fixing machines, writing poetry, being convivial . . ." and further, Wenger (1998) defined knowing as "a matter of participating in the pursuit of such enterprises, that is active engagement in the world" (p. 4).

After considering all the concepts discussed above, I determined that Hogg's definition three was the most appropriate to my study. I went to Hogg's Table 1 (Hogg, 2011) to determine the authors that Hogg cited who used the third definition of FoK in their research: Basu and Calabrese Barton (2007); Calabrese Barton and Tan (2009); and Upadhyay (2009). Basu and Calabrese Barton (2007) argued that FoK "include knowledge, actions, and disposition or habitus with a recognition of how each of these domains are culturally constructed and refined" (p. 468). Further, they argued that it was important to recognize the ways that an individual's life experiences "yield knowledge that is useful, powerful, and transferable" (Basu & Calabrese Barton, 2007, p. 468). Finally, and important to my study of this HRE, they argued that FoK should be not be viewed as "a list of cultural experiences that demarcate one's out-of-school life, but rather *strategic knowledge and activities essential for achieving the goals a student has for his/her out-of-school life*" (Basu & Calabrese Barton, 2007, p. 468). Calabrese Barton and Tan (2009) reported "diverse FoK that are grounded in students' membership and experiences in out-of-school worlds that they inhabit" (p. 52), and they identified talents and interests as FoK identified for middle school females. Upadhyay (2009) echoed Basu and Calabrese Barton's (2007) argument that students use FoK strategically to obtain future goals. Further, Upadhyay (2009) argued "Children learn ways of thinking, doing, utilizing, and making sense of new experiences through the knowledge that they have gained in their community and home practices" (pp. 218–219).

Using these concepts, I recoded my excerpts looking for what allowed students meaningful engagement or LPP in the social and scientific practices of this HRE's CoP: what knowledge (ways of knowing) the Lumbee participants contributed to the HRE and how their dispositions, talents, and interests (ways of being) allowed them meaningful engagement (Tan, Calabrese Barton, Turner, & Gutiérrez, 2012). Once this new open coding was accomplished for each Lumbee participant, I performed axial coding (Corbin & Strauss, 2014) to establish themes among Lumbee participants (see Table 8).

Below I provide descriptions of the Lumbee participants' ways of knowing and ways of being before, during, and after the HRE. Whenever possible, I let the participants speak for themselves. In order to do this, I transcribed their words as carefully as possible. Additionally, I made no attempts to indicate instances of when the participants' use of Lumbee English does not align with Standard English.

Group 1: Aaron and Barry (and Also Jewel)

The two Lumbee participants in Group 1 were rising ninth grade males: (Aaron and Barry). The two female members of Group 1 were also rising ninth graders: Judith (Asian/Pacific Islander) and Bonnie (White). Cole (White), the third male in the group, was a rising eighth grader. None of Group 1's participants was an expert (see Tables 4 and 5). As mentioned earlier, Jewel has been included here as well. In my discussion of the Lumbee participants' views of science before their engagement in the HRE, Aaron and Barry reported dismal school science experiences (Aaron's interview, 7/19/2012; Barry's interview, 7/19/2012).

Group 1's Ways of Knowing and Being before the HRE

Aaron. Aaron reported, "I don't do nothing in my science class" (Aaron's interview, 7/19/2012). He described his school science activities as follows:

> Looking like on telescopes [microscopes] and look at like old, you know like they're a little plastic thing you look at your telescope and you see it. We did that a lot. We dissected one frog. It wasn't even—it was like a dead frog that got squished and its guts was already out.

Despite his disgruntled view of these activities, Aaron felt that he had engaged well in his science class as he "answered all the questions and I did most of the work." Dr. W asked how Aaron contributed to activities, and he responded that he usually started them and answered most of the questions. Aaron used the following three words to describe himself: "funny, smart and unpredictable." He was funny because he caused his classmates to laugh the entire year. He was smart because he answered all the questions in math and science, and also in social studies. Aaron did not have a firm view of his "smartness" in school science. Later, when Dr. W asked him if he were smart in school, he replied, "Yeah, kind of." Aaron used the word "unpredictable" to explain his ethical behavior. He related that his best friend stole his teacher's phone. His classmates thought Aaron acted unpredictably when he reported his friend's theft.

His choice of the three smartest students in his classes revealed the reasons for his contradictory view of his science abilities. He tied smartness to the ability to answer questions. He described the first student, a male, as knowing a lot of science and answering all the questions. The second student, a female, would count to five when the math teacher asked a question, and if no one had answered, she would yell out the answer. Aaron's third choice was another male, and he judged his classmates' smartness based on his ability to answer questions on the Eighth-Grade End-of-Grade (EOG) tests. This classmate made fours (highest score awarded) on the three EOGs (Mathematics, Reading Comprehension, and Science). In Aaron's view these scores proved his classmate's smartness. Although he previously characterized himself as being smart in science, he seemed to change his mind. At this point in the interview, Dr. W asked, "Oh, okay and would you consider yourself a smart person in science?" Aaron replied, "Not really, not in science." Dr. W pointed out that this answer contradicted his earlier response that he was smart because he answered questions. At this point, Aaron characterized his smartness based on his performance on the Science EOG: "Sometimes I did rotten on the EOG. I made a two . . . because people would distract me. That's why I was by myself while I was taking that test. Sometimes people would distract me and stuff."

Aaron said his teachers at school would describe him as "a mean young'un." When Dr. W asked what he meant, he replied, "No, not a mean child – I think it would be nice, but maybe it wouldn't." Dr. W was still perplexed and asked, "You don't know how your teachers would describe you?" Aaron finally replied, "Nice." I think that Aaron's use of Lumbee English confused Dr. W. In Lumbee English, *young'un* or *young one* refers to a child. A mean person is an individual who stands up for what he or she thinks is right (Blu, 2001). Previously in this interview, Aaron reported that he told his teacher that his friend took her phone. His classmates did not think he would report his friend's theft, but he did what he thought was right. His behavior was *mean* in that he did what he felt was right, and not because he misbehaved in class, as Dr. W may have thought.

Barry. The poor views of science that Barry portrayed in his responses to the items on the pre-survey are echoed in his responses to the interviewer's questions about his engagement in school science. Barry described school science as "boring, sleepy, and aggravating." Barry said, "You don't do nothing but sit in class all day and [that] . . . makes me want to just go to sleep." School science aggravated Barry because, "they want you to do stuff that's not interesting." Barry reported that he played no part in school science activities: "I just let everybody else do it because it was too boring; I didn't know what to do." There was only one thing that seemed to catch Barry's attention at school. He felt that the most exciting part of school was "lunch." Perhaps because of his disengagement in school, Barry thought his teachers would describe him as “a trouble-making kind of person.”

Barry thought the three smartest students (two males and a female) in his science class “knew a bunch of stuff about science, and they got all good grades.” Barry felt he was not as smart in science as these students were: “What was different about me and them was they made all good grades on the tests, and I made bad grades and good grades.”

Jewel. Jewel was asked to describe herself during school science the previous year, she answered, “I was quiet, knew what I was doing, standbackish I guess” (Jewel’s interview, 7/19/2012). When asked why she was quiet in school, Jewel replied:

> I don’t really like to be the one that is, like, “Oh, I know, I know,” so I kind of keep it to myself. I may know what they are talking about, but I am just sitting there like I don’t know anything. . . . All the class would think I didn’t know, but I am usually the first one finished, got them all right and they were like, “Oh, she’s actually smart or whatever.” I’m like “Yeah, I pay attention; I’m just not all loud and stuff about it.”

Jewel said she was “standbackish” as she was “not the kind that is going to jump up and scream ‘I know the answer,’ I’m like, ‘y’all can go ahead and do it.’”

Jewel used similar language to describe her contributions to school science group activities. She was the one in her group that did not ask questions, but she “would pop up and give the answer before the teacher came.” In addition, she was able to finish all the “paperwork” associated with class experiments, as she actually knew what she was doing. She attributed her contributions to group science activities to her love of science:

> People usually go to school and they stop at school, and they don't like science. I will go home and look stuff up I didn't know in science, or continue reading about this, or continue about that, and actually keep going when it is not in school.

Finally, when asked how her teachers would describe her, Jewel once again used similar language to past responses: "Shy, but knowingly, like knowing what I am doing."

Jewel believed that she and her science classmates were equally smart as they attended early college:

> At a public school you have kids that don't want to be there, or they don't want to do this, or rebel and stuff, but we're wanting to learn and go ahead, and get this stuff over, and proceed in life. I guess, so we are already prepared.

Group 1's Ways of Knowing and Being during the HRE

Several educational researchers observed Group 1 during the week of the HRE. Unless I state differently, the qualitative data that I present for Group 1's activities during the HRE derive from their field notes, their contact summary sheets, and my transcriptions of audio files and video files that they made during their observations of Group 1.

Sunday. All participants engaged in elective activities and were not restricted to their research groups. Jewel, Barry and Aaron chose the snake bone jewelry elective. My information about this activity came from field notes taken by an educational researcher, and videos that I transcribed. Jewel worked on a pair of earrings, Aaron made a necklace for his mother, and Barry followed Aaron's lead to make a necklace for his mother. Aaron began readily, but the teacher leading jewelry making had to prod Barry to begin. The educational researcher noted that Jewel was very polite, and answered yes ma'am when addressed by a female adult. Dr. A brought a sassafras root for the students to smell. Jewel told the group about how her grandfather used sassafras to make tea. Daisy was also aware of the use of sassafras for medicinal reasons.

After dinner on Sunday, participants engaged in the evening frog call hike. An educational researcher was assigned to Group 1, but no researcher was assigned to Jewel's group. In her field notes, the educational researcher indicated that the Lumbee participants were quiet, and mentioned only Aaron specifically; no data were collected about Barry. She categorized the Lumbee participants as "disengaged." During the activity, Aaron began to voluntarily engage with the group using his sense of humor and storytelling talent; he told a story to the camp counselor. This was a significant event because it exemplified my belief that the Lumbee participants did not distinguish between HRE personnel and SCR personnel. The Lumbee participants considered all supervisory personnel as part of a single community. Aaron told the counselor that when he finished packing, he showed his clothing to his mother. His mother told Aaron that if he wore what he packed, he would look like a pimp. Aaron just laughed and continued his night walk. By this action, Aaron foreshadowed his effectiveness at community building through the practices of storytelling and the sharing of humor. Scholars have reported the importance of storytelling and humor in the Lumbee culture (Blu, 1994; Dial, 1993; Lucas, 2006), as it helps individuals from different communities establish rapport.

Monday. There was no educational researcher assigned to Jewel's group on Monday. Group 1 had stream amphibians as their morning study. No stream amphibians or fish were found in any of the ten minnow traps found at any of the five sites. At the first site, once the minnow traps had been inspected, the leaf pack was extracted from the stream and spread on white plastic so that participants could search for aquatic insects and other invertebrates. The female participants were willing to do this, but the males, including Aaron and Barry, were reticent. Aaron told the group that he had a cramp in his leg to excuse himself from looking through the leaf packs. The educational researcher felt that Aaron was teasing. The male assistant project leader teased the males about their lack of participation, and told them “these two girls are making you look bad.” After this banter, the male participants became involved in the search for invertebrates. After a while, the male participants ceased to search, and the male assistant project leader had to again tease them in order to get them to work.

Once all sites were processed, the group moved to the cafeteria to enter data on Android devices and iPads. Aaron began to process data using an iPad, but Barry and the other male participant were disengaged. When data entry was finished, the group put on waders and entered the lake with dip nets to see what they could find in the lake and its sediments. Aaron and Barry immediately engaged in this activity and inspected what they found in their nets. During this activity, Aaron mentioned that it had been a long time since he had worn waders for fishing. The assistant project leader continued to tease the male participants, and Aaron teased him back. Aaron told the assistant project leader to toss him a knife; they would eat “allie” for dinner.

The group moved back to the cafeteria for group story time. No Lumbee was involved in telling Group 1’s story this day.

All groups engaged in CASP Monday evening. Again, no educational researcher attended Jewel's group, so no data were gathered about Jewel. Group 1 moved among six frog call locations at SCR and listened for two minutes at each location in order to document species and relative abundance of calling frogs. The participants were encouraged to identify the species that they heard. Aaron and Bonnie were in charge of data entry using the Androids, and they had difficulty using the Androids. In her field notes, the educational researcher questioned Aaron's previous experience with technology, but she noted that he persevered and tried his best to enter data properly. Barry remained quiet throughout the CASP activities, and the educational researcher provided no information about him. Aaron was very interested in the concept of frog "eye shine" (reflection from an eye that is exposed to a bright light). Aaron shone his flashlight into the water and said, "I see it." As it was nearing 10:30 PM, Group 1 returned to the cafeteria, and then to their cabins for the night.

Tuesday. Again, no educational researcher documented Jewel's group's activities. Group 1's morning field activity was lizards. During the course of Group 1's activity, the project leader introduced cryptic coloration. Although Aaron would subsequently report in his interview that he didn't like science, and didn't know a lot of science, he made the following statement: "Colors, it depends on the habitat it comes from, and camouflage from predators. If you can't find us, you can't eat us." Later, the project leader told the group that she had placed plastic lizards at different levels on the cafeteria walls so that they could practice lassoing them at different heights. This skill was necessary as lizards are arboreal. She asked the group what arboreal meant. Aaron responded “trees, means they like trees.” As the project leader discussed how to go about finding lizards, Aaron said he and the stream amphibian assistant project leader had seen six lizards the day before. Later, the project leader asked if anyone had caught or been bitten by a lizard before. Aaron reported that he had caught lizards with his cousin, had been bitten, and had worn lizards biting his ear as earrings. During the search for lizards in the field, Aaron related “I always find my lizards on wood.” In her field notes, Dr. A categorizes Aaron and Bonnie as the group leaders.

I felt that Barry’s engagement in the HRE CoP began to increase during this field activity. Unlike Aaron, Barry tended to be a follower, not a leader. Barry bonded with JT, the SCR counselor assigned to Group 1. JT became Barry’s mentor and, subsequently, Barry practiced lassoing lizards with JT. Barry and JT learned this task cooperatively, and Barry chuckled at JT when he finally lassoed a lizard. Barry and JT continued to work together when the group moved to the field. JT endeavored to keep Barry engaged when his attention faltered. Barry also became engaged when he was put in charge of recording video of a Six-lined Racerunner as it was timed negotiating a pre-arranged racecourse. Aaron helped Barry understand how to use the Android to video this event. In general, Barry became more engaged whenever his group was working with live animals.

Once the morning activity was over, Group 1 returned to the cafeteria for group story time. Neither Barry nor Aaron told Group 1’s story.

On Tuesday evening the HRE participants engaged in science electives. Due to the distribution of educational researchers among the electives, I have no data on Jewel.

However, Aaron elected to sculpt a rattlesnake using Model Magic clay and paint. Barry participated in the snake dissection. I was the educational researcher at snake dissection.

Once Aaron created a large snake from his clay, he called the elective teacher to his station. The leader complimented him on his model. Aaron pointed to the Box Turtle project leader, and told the elective leader that she had made the snake's head, making it clear that Aaron and the Box Turtle project leader should share credit for the design. Aaron used a piece of plastic gutter guard to mark the clay to look like scales. Aaron used his herpetological field guide in order to have a realistic color pattern as he painted his snake. Dr. A asked Aaron what kind of snake he had made, and he said he had created an Eastern Diamondback Rattlesnake. Dr. A asked Harold, who was also present, what he was making. Harold responded, "I'm making the same thing as him, but mine is black." Aaron said, "It's a combined effort. I am designing, and he is drawing. Real people do it in pairs." Aaron spoke to Harold, "High five me on that one." A high five and a fist bump followed. In her field notes, the educational researcher wrote that Aaron came to her table and proudly showed her his snake, which he named Two Chains. Aaron led educational researcher back to the art table, where Thomas and Harold admired Aaron's work. Aaron told a story about Two Chains. One day Harold, Thomas and Aaron encountered Two Chains. Aaron used a stick to beat the snake in order to save his friends. The educational researcher wrote that Aaron's story was amusing. The art elective leader embellished the story by saying that Aaron had hypnotized Two Chains, and that was why the model snake was frozen in place. Before all was said and done, the whole group was adding to Aaron's tall tale.

Barry's Tuesday night elective activity was snake dissection, which I observed. Barry exhibited the highest levels of engagement I had yet seen during this activity, and he thought snake dissection was "pretty awesome." A dissection leader asked if Barry's snake was male or female. Barry responded, "Don't really know. Is it by the length of the tail?" The dissection leader told Barry how to dissect the snake to help sex it. Barry also dissected the stomach, and he was very proud that he was able to tell the snake had eaten a bird. At one point, Barry diligently tried to get the skin off his snake using a scalpel. Barry also showed Culbreth, one of the deaf participants, how to properly use a scalpel to scrape tissue away from the snake's skin. Although he was previously extremely quiet, Barry recounted a story to the group at his table. He talked about visiting a snake farm where he had seen what he imagined to be a twenty-five foot Boa Constrictor.

Wednesday. Jewel's group worked with stream amphibians. I was able to collect data on Jewel from video files made that day that I transcribed.

Jewel did not speak often, but when she did, she was soft-spoken. During the activity, Jewel remained on the periphery of the group but always paid close attention to what was going on. An exception occurred when Dr. A asked Jewel if she could see the dragonfly nymph, and the other participants shifted so that Jewel could move to the front and see the animal. It was clear that Jewel was engaged, because she could tell Dr. A what duckweed was when asked. When the group encountered a snake, Jewel stayed calm and did not squeal like some female participants did. Just the opposite, she moved closer for a better look at the snake. She also engaged by entering data on the Android.

Other than the Sunday night elective, this is the only block of data available about Jewel. Due to the lack of data, and also due to Jewel's quiet demeanor, it was almost impossible to create a profile of Jewel's trajectory through the HRE. However, Jewel's behavior exhibited above is very typical of many Lumbee students. They are quiet and reluctant to put themselves forward in groups. However, they understand the importance of education and remain quietly engaged (Harrington, 2012).

Wednesday evening's activity, nature photography, was monitored by educational researchers, but produced little useful data with respect to my dissertation. An exception was data about Aaron that came from my transcriptions of video taken by Dr. D, a senior HERP Project educational researcher. Other educational researchers had told Dr. D about Aaron's Two Chains story, and she wanted to video his tall tale. Aaron insisted that he had to find Thomas before he told his story. After he returned with Thomas, he told Dr. D his story with his arm around his friend's shoulder. Aaron's story began this way: "Me, and Tommie-Tom Tom, walking through the woods you see, and kicked that dead pine tree, and there lies a timber rattler, a timber rattler. He did not see it, and he stepped on it." Aaron related how he had to save Thomas's life. Aaron got his big flashlight and threw it at the rattler, hitting it, and after that Thomas was able to run away. Aaron continued the story, complete with an explanation for white spots (cracks in the paint) that had developed as the model snake dried. Dr. D asked Aaron when he made his model snake and how long it took. He responded that he had made it the night before, and that it took an hour and 40 minutes. Aaron explained, "I had to make myself something good, so I can take it home to show my parents." Dr. D asked Thomas what had been his favorite HRE activity. Thomas responded that he had enjoyed looking for animals with people who could answer his questions about herpetology and “guys like Aaron who make it really fun.”

Thursday. Group 1’s Thursday study was aquatic turtles. Data for this activity came from my transcriptions of videos taken by Dr. D. This activity required the extraction of large, and potentially dangerous, aquatic turtles from mesh traps that were in the water. Both Aaron and Barry had the opportunity to assist Dr. W with the extraction of turtles from two different traps. Both individuals eagerly donned their waders and got in the water with other participants, making sure to closely follow Dr. W’s instructions.

In Aaron and Bonnie’s first trap, the group found a snapping turtle that needed to be handled with care. Barry described the turtle as “vicious.” A fish was trapped in the netting and needed some effort to be released as it was trapped by its dorsal fin. Aaron was concerned for both animals and was glad when Dr. W released the Snapping Turtle and the fish. The first trap yielded four turtles: the snapper and four Yellowbelly Sliders. There were no turtles in Aaron’s second trap.

Barry and Judith pulled the third and fourth traps. In their first trap, they found a Yellowbelly Slider; the data do not specify if they caught anything in their second trap. After the traps had been checked, the group processed the captured turtles. Aaron worked with the assistant project leader, and they had trouble correctly identifying their turtle. Aaron consistently called the animal a “cooter,” while the assistant project leader tried to convince him that the animal was in fact a Yellowbelly Slider. In Lumbee

English, cooter refers to an aquatic turtle of any species. Scientifically, the term "river cooter" refers to a single species of aquatic turtle; hence the confusion in identification.

While Barry was processing turtles with Bonnie, he became concerned that Bonnie had scratched the turtle's shell. Barry attempted to express his concern to the group, but just then a gravid turtle was discovered, and his concern was lost in the group's excitement over that new discovery. Aaron's empathy for animals also momentarily disrupted the processing of turtles; he would not file the identifying marks into the turtles' shells. When Dr. D asked him why, he responded "It hurts me when I file myself, so why would I file something else; if when I do it to myself it hurts. So, I do it to something else, and I know it will hurt?" Cole told Aaron that filing would not hurt the turtles. Aaron replied, "You don't know that. Can you read its mind?" Cole asked, "Can you?" Aaron responded, "Yes I can, I speak turtle." For a while, these two turned their backs to the group and each other. Dr. W approached Aaron's group to show them how to file a turtle's shell. When she finished her demonstration, she told the participants that she expected each person to file a little bit more on the mark that she had started. With Dr. W's help, and following her instructions, Aaron began filing.

Towards the end of turtle processing, Dr. D and Aaron discussed his storytelling, because it was Aaron's turn to tell his group's story at group story time. Dr. D told Aaron that he was a good storyteller, but Aaron replied that he was not, and "that's why I don't tell them." Dr. D responded that he had told her a good story about Two Chains the night before, and his story had been very engaging. Aaron asked, "Are you talking about that story? I made that up on the spot." Dr. D laughed and responded, "Different kind of story, right?"

On each day, before lunch, each group told its story about the morning activities. Until Thursday, no Lumbee participant had told Group 1's story, but on this morning Aaron told his group's story. As Aaron recounted his group's morning activities, he emoted dramatically with many hand gestures, and when he was through, he gave a flourishing bow. However, Aaron was not done: He told a story about how JT had caught a Five-lined Skink. Aaron said the skink bit JT, and that JT cried. During this story, another participant loudly mocked Aaron's pronunciation of skink; Aaron continued his story without pause.

Thursday evening's group activity was a talent show. Neither Barry nor Jewel participated in the event other than being audience members. Aaron danced with several participants from his cabin. He danced next to Thomas, his new science friend.

Friday. No data for Group 1 or for Jewel were collected on Friday.

Group 1's Ways of Knowing and Being after the HRE

Aaron. The information for this portrait was gleaned from Aaron's interview (7/19/2012). Aaron was proud of his elective activities: "I felt good about myself when I made that snake, and when I made that jewelry for my mama." In addition, Aaron was proud, "because, now I can show my people at home what I did, and they won't . . . if I say I made a rattlesnake, they will believe me." Aaron felt he had contributed to Group 1's activities by "telling them what to do." At first, Aaron reported he had not contributed anything to the whole group. After some thought, he said he had contributed to group story time before lunch that day. Aaron described his skills that allowed him to make his contributions to the larger group by saying, “I’m good at designing, making arts and crafts, and telling stories and stuff, because my family made stories.”

Aaron described himself during the HRE as “outgoing, exciting, and fun.” He was outgoing because “whenever we try to do stuff, I try to do my hardest . . . and whenever we done turtles, I was trying my hardest not to fall.” Aaron explained his excitement by saying, “I have never seen so many turtles. I never really . . . like I handled some, but I never really like got to do them, and measure them, and weigh them.” Aaron was a fun person because he invented a game called Ultimate Ultimate Dodge Ball that he introduced to his cabin mates. Other participants mentioned this game during group activities, thus confirming the popularity of Aaron’s invention.

Aaron named Thomas, Bonnie, and Judith as the three smartest HRE participants. Aaron said Thomas “knew way more stuff than me, and has more animals and everything.” Aaron and Thomas became friends who talked about science. Aaron said that the two females were smart because they could answer questions, and Judith knew more about turtles than he did. Aaron did not think he shared any characteristics with these three. Aaron thought he knew a lot about animals, but did not know a lot about or like science. Aaron seemed to distinguish between being smart in science and being smart in natural history. He thought he was smart in natural history, and had learned a lot of natural history concerning herps during the week, but did not see himself as smart in science. Aaron felt that the HRE staff would think of him as “awesome.”

Aaron said that his skill with arts and crafts increased during the HRE. He also reported that he had learned field skills that would allow him to be more comfortable around animals in general and turtles in particular. During the HRE a turtle bit Aaron, but he learned to wear gloves if he wanted to handle turtles in the future.

Barry. The information for this portrait was gleaned from the Barry's interview (7/19/2012). Barry was proudest of finding "the Yellowbelly Slider in the trap." He was proud because he held the turtle and returned it to the water. When asked what his contributions to his group during the week were, Barry responded that he "read the tools," and pulled both minnow traps and turtle traps from the water. When asked about his contributions to the entire HRE, Barry responded that he did not think he made any.

When asked to give three words that described himself at the HRE, Barry said, "finding turtles, finding different types of animals in the water, finding lizards and shells." When asked to elaborate, Barry indicated that these three activities were a result of his interest in finding animals. Barry further stated that he would find lizards at his home, capture them, and then let them go.

Barry listed Robert, Carter, and Kyle as the three smartest HRE participants. Barry thought they were smart because they already knew a lot about animals. Barry believed that he and Robert, Carter, and Kyle shared a desire to learn more about animals. Barry believed that the HRE project leaders thought he was "exciting." The skill that he had learned during the HRE that he would take home was, "pointing out the different types of turtles, and lizards, and different types of frogs."

Jewel. The information for this portrait was gleaned from Jewel's interview (7/19/2012). Jewel was proud of "holding the smaller snakes, because they're faster" than the larger snakes she was used to handling. Jewel felt she contributed to her HRE group's activities because she would "go out and empty the traps, and do all kinds of things, look for stuff, and everything." Jewel did these things because she "wanted to, it was fun and interesting." Jewel felt her contributions to the entire HRE were "catching things and letting them study them, and stuff like that." Jewel's skills that helped her catch animals were "not squealing like a little girl, or being scared to actually touch them and stuff like that." Jewel described herself during the HRE as "interested, fun, interacting." Jewel was interested because what she learned was different from normal science camps. Jewel felt the HRE was "fun and interacting" because she got to interact with people and animals in a hands-on environment.

Jewel felt the three smartest participants at the HRE were Kyle, Carter and Thomas. Jewel felt they were smart for the same reasons: their impressive knowledge of reptiles and amphibians, and how to catch and handle such animals. Jewel was not sure whether she shared any of these characteristics. Jewel believed that the HRE project leaders would describe her as "somebody that didn't talk a lot at all." During the HRE Jewel believed she had learned skills she could use when she returned home. She felt she had gained awareness of animals and their potential for harm, and she had learned to be aware of animals and to be careful when handling them.

Group 2: Dalton, Larry, and Sherry

The three Lumbee participants in Group 2 were rising ninth graders: Dalton, Larry, and Sherry. Additionally, there were two non-Lumbee members of the group who were also rising ninth graders: Erin, a White female, and Chandler, a White male. Chandler was the group's a priori expert participant (see Tables 4 and 5).

Group 2's Ways of Knowing and Being before the HRE

Dalton. During school Dalton described himself in school science as "determined to pass, smart, observative." He was determined to pass and he had listened and paid attention all year, and knew he could pass the test. Dalton was smart because of his grades: he made As and Bs in science (Dalton's interview, 7/19/2012).
Dalton explained what he meant by being observative by saying, "I was observative because I knew if I was observative, I would pass the test." When the interviewer felt that Dalton had implied learning was all about passing the test, Dalton responded: "It's about learning. It's about learning for life."

Dalton reported that the previous year his science class conducted group science experiments. He contributed to these experiments by giving his classmates the materials they asked for and by observing what happened so that he could tell them if they missed anything. Dalton explained the importance of his contributions to the group's experiments by saying, "I knew I had helped other people learn, and helped myself learn." Dalton felt his teachers would describe him as "helpful."

Dalton believed that the three smartest individuals in his science class made good grades. Dalton felt the three were smart because "they paid attention, and listened to the teacher, and took notes." Dalton felt he shared characteristics with these 'smart' students because he took notes and observed.

Larry. I assume, based on Larry's consistently short interview responses, that he was somewhat reluctant to discuss himself with the interviewer. Larry did not attempt to provide an example of a school activity of which he was proud. Larry described himself in school as "motivated, smart, engaged." Larry was motivated "because with homework and stuff, doing classwork, I always do it." He was smart "because I always made As and Bs" Finally, he was engaged "because I was always into what the teacher was saying."

Larry said that he "help[ed] them out with different stuff" to contribute to his group's efforts in school science. Larry said his teachers would describe him as "nice." Larry listed two females and a male as smartest students in his class. He said first female "always had an A in that class, she had ninety eight to one hundred percent all the time," and he said essentially the same things about the second female. Larry said the male "knew everything." Larry felt he shared characteristics with the smart male. He said that he did not know everything, but he knew a lot (Larry's interview, 7/19/2012).

Sherry. Sherry said "If I get a good grade on a test, I am proud of myself." Sherry used only two descriptors for herself in the past year's science class: "Well, I was proud, I was eager, and I don't really have another one." Sherry was proud of what she viewed as her improvement in school science. She had not scored well on her fifth grade science EOG, but she made a four on her eighth grade science EOG. Sherry was eager because “we don’t have science in sixth and seventh grade, so you miss all that. But in eighth grade, you find out all this different stuff, and you are just so eager to learn it all.”

Sherry listed a female and two males as the three smartest students in her science class the year before. She described the female as a super smart person who took good notes who was a role model for everyone. The first male made straight fours on the benchmarks. Sherry said the second male made straight fours on everything, and got straight A’s. She felt she shared characteristics with these three: “I know a lot of stuff now, and I did like make a few, yeah, I made a few fours on my EOGs . . . I made A’s on my science and stuff.”

Sherry felt she contributed to her school science groups by being helpful: taking measurements, mixing chemicals, helping students with understanding the material. She explained the importance of being helpful:

> Like if you know something, and they don’t, it’s best to go ahead and tell them so they will know in the future. So they can educate someone about it . . . because it’s a group project, so you have to be in the group and stuff . . . if you don’t participate in a group, it’s no use being in a group.

Sherry felt her teachers would describe her in the following way: “My teachers would say I’m very outgoing, like to help others, and I’m intelligent” (Sherry’s interview, 7/19/2012).

Group 2’s Ways of Knowing and Being during the HRE

A single educational researcher was assigned to Group 2, and she observed the group for the entire week. Unless I state differently, the data I present for Group 2 comes from her field notes, contact summary sheets, and my transcription of audio files and video files that the educational researcher recorded throughout the week.

Sunday. The first information I have for a Group 2 member is for Sherry, who did the Leaf Litter Critters elective Sunday night. During this elective, participants used a wire mesh shaker box to separate invertebrates from the leaf litter and topsoil samples that they collected from the nearby forest. The participants shook the boxes to separate the invertebrates from the soil and leaf litter of their samples. Participants then identified the invertebrates using keys provided for them. Larry and Dalton performed electives that were not observed by an educational researcher, so no data on their elective activities is available.

Sherry and Tonya worked together to collect and process their leaf litter sample. Roger, a White male participant, danced and vocalized in an obvious “movie Indian” fashion when he shook his leaf litter sample. Though the two Lumbee females did not respond to Roger’s actions, this is the first observed instance of American Indian stereotyping on the part of other HRE participants.

After dinner on Sunday, participants engaged in the evening frog call hike. The participants were required to be in their group for this activity.

When Group 2 organized at the cafeteria, Larry immediately told the group which direction they should go. Once the group set out across the wetland bridge, Larry and Dalton took the lead. Erin, a non-Lumbee participant, and Sherry discussed snakes as they walked, sharing their fears about them and walking at night. As the group proceeded along a dirt road, they came upon a mud puddle. Dalton noticed the puddle, and said, “Something has been drinking out of it.” Dalton said he could tell this because he saw “paw prints, tracks.” Dalton thought a raccoon had made them. Chandler found a possible snake trail, and the other participants found bird tracks. These finds inspired a search that revealed another set of tracks that Dalton believed had been made by a fox. Larry thought the tracks were of an opossum; he thought the prints were very clear which meant they were fresh. The group decided to move on, and Larry and Dalton assumed the lead positions. Erin, Chandler and Sherry began to notice spiders and to tell spider stories to one another. Sherry approached Dalton and Larry toward the end of the walk, and asked them what they were looking for. Dalton said they were “looking for trouble.” The conversation turned to the proper way to pick up a snake; Dalton and Larry thought snakes should be picked up just behind the head. The educational researcher told them to pick snakes up by the “mid-body,” but to never pick up a snake unless they could identify it.

Monday. The project leader for the lizard study began by introducing the participants to using Androids to gather data; after this the participants made lizard lassos in order to catch lizards. The teacher assigned to Group 2, emphasized that the participants should be diligent in entering data into the Androids and also their science journals. During this time, Chandler (the group’s a priori expert) answered most of the questions while the other participants, including the Lumbee participants, were quiet. After this discussion, the group practiced catching plastic lizards taped on the walls with their lassos. Dalton was the first volunteer to lasso. Dalton and Larry calmly and efficiently worked together during this practice, but said little. When complimented on their skills, they simply smiled, but rarely talked. The project leader noticed that both Dalton and Larry caught their plastic lizards by the leg, not by the neck as they had been instructed; she told them that they could catch them that way.

The group proceeded into the field to lasso live lizards. As they did the night before, Larry and Dalton assumed the lead positions at the head of the group. Also, as again was the case the night before, Erin, Sherry and Chandler created a second sub-group. The group walked across the wetland bridge, and the project leader told them to watch for anoles once they reached the end of the bridge. Once off the bridge, Larry and Dalton approached the vegetation where anoles might be located. At this time, Larry and Dalton became quietly, intently observant. Dalton was the first to catch a lizard; he caught it by its back leg as he had practiced. Being sure to follow procedures, Dalton placed the lizard in a plastic container and marked the spot where it was captured with duct tape. He immediately recorded these events in his science journal; he was the first participant to do so. Sherry told the educational researcher a story. Her father would catch anoles and hang them from her earlobes like earrings. Dalton and Larry continued to lead their group. Sherry continued to search cooperatively with Erin. During the outdoor lizard catching activity, Dalton used the Android and an app called My Tracks in order to continuously document their route.

Once back at the cafeteria, the group processed the two lizards they had caught. Dalton and Larry processed the lizard Dalton caught, while Sherry, Chandler and Erin processed the other. Sherry, very comfortable while processing her lizard, said, “His name is Bob.” Larry deferred to Dalton when processing the lizard, and said, “It’s creepy, go ahead." He passed the lizard container to Dalton, who recorded snout-vent length and mass. As before, Dalton conscientiously entered data into his science journal without being told to do so. Dalton dictated the information from his journal to Larry who entered the data into the iPad while simultaneously playing Tap Tap Ants. Later this game was used as an instructional tool when the group tried to see if the anoles would respond to the ants in the game and try to eat them. Although Larry played the game, he quickly became engaged in data recording when necessary. It was evident that he had also been entering data into his science journal because he provided a snout-vent length from his journal that Dalton had failed to record.

The group tested lizard responses to the ants on the Tap Tap Ants game and also lizard responses to live crickets. The lizards did not respond to the ants, but ate smaller crickets. The group decided that the ants on the iPad screen might have been too large for the lizards.

At this point, the group decided that Erin would start the group story of their morning activities during story time, Dalton would tell the middle part of the story, and Chandler would tell the end of the story. The group left the cafeteria, and gathered with the other groups under the big oak tree beside the cafeteria. After Erin told her part of the story, Dalton stepped forward and said matter-of-factly, "I lassoed a lizard today." Someone asked what kind of lizard, and Dalton responded that it was an anole.

Group 2's Monday CASP evening activity was uneventful until the group arrived at calling location number two. Once the listening at location two was over, Larry transferred the Android to Sherry who was supposed to enter the data for location two. In doing so, Larry purposefully shone his headlamp in Sherry's eyes. Sherry responded by saying, "You need to stop with your light, son." Sherry further told Larry that she would "retaliate" if he persisted in his behavior. Chandler teased Sherry by saying she had used a big word (retaliate). Chandler continued that retaliate was not as big a word as "hippopopomonstrosesquipedaliophobia." Sherry replied, "Shut up, I don't even know what that means." Chandler replied that he had a fear of people named Sherry. Sherry said, "You should. Actually, you should. You don't want me to get loud." Sherry told the project leader that she was having trouble with the Android, and Chandler made a derogatory noise. A project leader told Sherry that the problem was with the new apps, not with her abilities to use the device. Chandler attempted to elaborate on the project leader's remarks to Sherry. Sherry replied to Chandler, "You are spitting in my face, thank you." Everyone than became quiet for the two-minute listening period. After the listening period, the group discussed what frogs they had heard. Sherry indicated that she had forgotten the name of one of the frogs she had heard, and Chandler made fun of her once again. Despite her problems with remembering frog names, Sherry continued to be engaged and made sincere efforts to help her group. The group continued to frog call location three which was Mr. R's location. The Android continued to act up and the timer would not work. Dalton said that he had a timer on his watch and that he would become the group's timer. At the end of the listening period, Mr. R asked the group what frogs they had heard and at what intensity. Dalton and Sherry engaged with Mr. R in an extended discussion about what they had heard. On the way to the fourth frog call location, the educational researcher complimented Dalton on keeping up with the My

Tracks app on the Android. After the fourth station listening period was over, the group heard an unusual noise. Larry teased that it was “the wild hog.” Dalton replied, “I believe I saw one running through here.” The three Lumbee participants laughed about the joke. Chandler shone light into Dalton’s eyes and told Dalton, “You suck, sometimes.” Larry made fun of Chandler by mimicking his statement to Dalton. The group moved on to location five, and collaboratively identified frog calls and their intensity. At this point, the group began to move down a dirt road toward the cafeteria. While walking, Chandler asked Dalton, “You want to go, bro?” Dalton replied, “Not against you at this place.” Chandler continued, “Dude, you want to wrestle?” At that moment, a diesel tractor passed the group, pulling a trailer load of hay. Dalton remarked, “That stinks.” Chandler tried to imitate Dalton’s accent, “That stanks.” Larry responded to Chandler’s jibe by talking like a movie Indian, “Hmm . . . that’s diesel . . . smells good.” Sherry joined in, “You want me to talk White?” Chandler asked, “What are you guys talking about?” Dalton said, “I don’t want to say nothin’.” Larry laughed. The educational researcher interjected that if people say things in a different way, “It is not worse or better, it is just different.” She suggested that Lumbee English might have roots in Old English. When Sherry told Chandler that she lived in the country, in part to explain her accent, he called her Little Red Riding Hood. Continuing this conversation about living in the country, Dalton told the educational researcher that he often visited Harold, another Lumbee participant, at his home. Harold lived on a 250-acre farm with two ponds and some springs. Dalton told the educational researcher that he and Harold swam and fished in Harold’s ponds, and that they caught shell crackers and catfish.

Dalton said he did not eat the fish he caught, rather he returned them to the ponds, "That way they will get bigger and I can catch them again."

Despite the difficulties that Sherry experienced with Chandler, the educational researcher wrote in her contact summary sheet for Group 2's CASP experiences that Sherry was able to form an alliance with Dalton and Larry as fellow Lumbees, with Erin as the other female, and with Chandler as someone she could joke with.

Before analyzing Group 2's CASP walk below, I feel it is necessary to state how unusual some of the interactions in this group were. When considering all the HRE participants, I conclude that relations between individuals were, with one exception, harmonious, inclusive and cooperative. However, there was a single exception to this rule that involved Group 2. The first evidence of this minor problem was seen during the CASP walk.

A unique aspect of Group 2's CASP walk is the ongoing interaction between the three Lumbee participants and Chandler. As good group members, the Lumbee participants were using humor to engage with one another. Chandler also thought he was being humorous when he teased Sherry about her use of words. Sherry possibly interpreted his teasing in a negative way, as Lumbees have suffered discrimination because of their unique dialect (Wolfram & Dannenberg, 1999; Wolfram & Sellers, 1999). I think it is clear that Sherry felt that Chandler was criticizing her dialect because she told him that she knew how to talk White. Lumbees refer to talking White or acting White as a reference to using Standard English (Harrington, 2012; Scott, 2008; Wolfram, 2000). Sherry may have responded with Lumbee *meanness*, a term that Blu (2001) linked to a Lumbee's pride in being American Indian. *Meanness* implies sensitivity to insult, and the willingness to stand up to the perceived insult. The three Lumbee participants exhibited cohesiveness in the face of Chandler's ribbing. Chandler ultimately challenged Dalton to a wrestling match; Dalton demurred. Others have documented Lumbee cohesiveness. An aspect of cohesiveness is presenting a unified front in the face of discrimination (Blu, 2001; Sider, 2003).

Tuesday. Before the group left the cafeteria for the field, the educational researcher and Sherry had a conversation about hunting. Sherry informed the educational researcher that she hunted and that she had six fox hunting dogs. As the group left the cafeteria area for the field, Dalton led one of RJ's turtle dogs on a leash and Larry lead another dog. RJ and the project leader were at the front, but Dalton was beside them. RJ released the dogs once the group was in the woods. While the dogs searched for Box Turtles, the educational researcher and Larry talked about the fact that Larry's family raised chickens on their farm. As part of his farm chores, Larry had to get up at 4:30 AM. As the conversation continued, Larry told the educational researcher that he and his friends hunted rabbits on a 700 to 800 acre property. After an extensive search, the dogs failed to find any turtles. The Box Turtle project leader left the group, and hid a turtle found the day before, so that the dogs could find it. As the Box Turtle project leader hid the turtle, RJ allowed the dogs to swim in a drainage ditch. Once the Box Turtle project leader rejoined the group, RJ released the dogs to find the hidden turtle, and after a brief search it was found. As the participants processed the turtle, Larry and Dalton walked over to RJ who stood in the shade with his dogs. The educational researcher approached the three and asked Larry if he had any Box Turtles on his property. When Larry responded negatively, the educational researcher asked him how he might find out if there were Box Turtles on his property, even if he had no turtle dogs. Larry considered the question for a bit, replied succinctly, “Go walking in the woods.” When asked where he might look, Larry indicated that he would look, “around logs and stuff.” Larry thought further, and began to describe his property, “In terms of our house, like our house is here, there is a big canal, and we can just drive by on a golf cart, scoop up turtles, four or five about that big.” Larry held his hand seven or eight inches apart to indicate the size of the turtles. RJ asked Larry was he talking about water turtles, and Larry said yes. RJ said that the turtles were probably Painted Turtles and Yellowbelly Sliders. Larry said his family could just get off the golf cart and scoop up the turtles in a bucket. Dalton said that all he saw on his property were snapping turtles. RJ asked Larry if there were “‘gators right around here.” Larry replied, “The only ‘gators that I know of around here are down there at Lake Waccamaw.” RJ indicated that he had asked this question because he was worried about his dogs, “‘Gators will take a dog in a second.” During this conversation, RJ clearly recognized Dalton and Larry’s knowledge of local ecosystems in order to alleviate his concerns. RJ said his dogs would be like a chip or a nugget to a ‘gator, and that scared him to death; the three laughed. Once turtle data processing was over, the group headed back to the cafeteria. Once more, Larry and Dalton were in charge of walking the dogs on their leashes. During the walk, Chandler again commented on Sherry’s accent. Sherry responded that Chandler didn’t need to be telling her how to talk. Erin supported Sherry, and told Chandler that he needed to learn to talk hillbilly.

The group assembled under the big pine tree by the cafeteria for story time. Sherry presented her group's story in a very self-assured way despite the fact that her accent had been categorized as "hillbilly" a few moments before. She smiled broadly the whole time she talked.

Group 2 members engaged in electives on Tuesday evening. I documented Larry and Dalton's activity, snake dissection that they performed together. Sherry engaged in a different elective that was not documented.

Dalton, Larry and Tinesha worked together to dissect a snake. The elective leaders helped the group when necessary. I talked with Dalton and Larry throughout the activity. I asked Dalton where he lived. Dalton replied that he lived in the country close to the local university, and that his family owned a large farm equipment business that was housed on the family property. When I asked if there was water on the property, Dalton responded, "I got canals." I asked about the difference between drainage ditches and canals. Larry replied, "A ditch is just a little thing, and a canal is . . ." Dalton finished for Larry by saying, "Big and it has Snapping Turtles." Dalton told a story about a snapping turtle coming out of a canal and getting under his family's car. Dalton's father asked one of his employees to remove the animal, because the employee, "bes brave and stuff." The worker kicked the turtle from under the car and removed it. I asked Dalton and Larry what was the purpose of the drainage canals. Larry responded, "To drain." I asked them what the landscape around their homes would be like if there were no drainage canals. The two responded simultaneously, "Flooded."

At this point, Dalton and Larry were dissecting the digestive system of the snake. A project leader helped them find the snake's esophagus. Larry remarked, "That is like a big canal." Dalton laughed, and said to Larry, "We came up on a drainage canal on the turtle hunt today. Do you remember that?" Larry said that he did. I asked Larry if he was a hunter, and if so, what he hunted. Larry said he only hunted deer, dove and rabbits. Larry hunted with his grandpa, his uncle and few of his cousins. Dalton interjected that he did not hunt personally; he just fished on his friend Harold's property. Dalton asked me if I had ever eaten "gator." I replied that I had never eaten alligator, but that I had eaten snake. Dalton responded, "You need to eat some 'gator." Dalton said that he had eaten alligator in New Orleans when his family had visited there. When asked if there were alligators on his family property, Dalton rolled his eyes with a smile and said no. When I asked Larry where he fished, he said his family sometimes fished at Jordan Lake, and that they had seen bald eagles there.

During the course of the dissection, Dalton continually told Larry and Tinesha what to do. When I asked Larry if Dalton was always this bossy, Dalton responded, "No, I just think we've got to finish all these things." Sometime later, Dalton again told Larry what to do. I again asked Larry if Dalton was bossy. Larry laughed, but Dalton responded that he thought Larry was struggling with what he was doing, and he was just trying to be of help.

Later, the conversation returned to hunting. I asked Larry if he had ever cleaned and processed a deer. Larry explained that you ". . . take all the guts out, pull the hide, get the meat." During his explanation, Larry said, "A deer is rotten." Larry was surprised when I asked him what he meant when he said that the deer was rotten. I told Larry that I thought rotten meant spoiled, and Dalton inserted, "decayed." Larry explained, "Not being cleaned, its rotten, like it's a real bad smell, it stinks." I asked Larry if he was referring to the intestines when they gutted the deer. Larry replied, "Yeah. That is what we call rotten. . . Like this snake, it's rotten." I asked Larry if his family butchered the deer, and he responded that they did. They would hang the deer and drain its blood, and then use a saw to cut off the legs.

When I asked Larry if he was going on the night walk, Dalton again answered for him, "Yeah, he's a'goin." I asked them if they had ever walked in the dark before the HRE. Dalton responded that he had to go out at night and walk from his house to his father's office on the property in order to give customers keys to the farm equipment. Dalton also said he walked in the woods at night for fun. Larry said that he walked in the woods at night with his friends to play hide and seek. Fifteen minutes later, the elective project leader said it was time to clean up and dispose of the animal material. At this point, the elective was completed, and Dalton and Larry left for the night walk.

Wednesday. Group 2's morning activities were uneventful. Dr. W introduced the group to the study of aquatic turtles, and after the introduction led them across the wetland bridge to the first aquatic turtle trap. Sherry and Larry were to open the first two turtle traps, and they put on their waders so they could walk to the traps without getting wet. Larry put on his waders quickly and without help. Sherry had trouble with her waders, and the assistant project leader helped her. Unfortunately, no turtles were found in the first two traps. Dr. W chose Chandler and Dalton to open traps three and four. Chandler and Dalton had trouble putting on their waders, and Larry stopped and teased them about it. Dalton laughed about the teasing, but Chandler did not. The group found three turtles in the third trap. Dr. W extracted the three turtles from the trap, and they were passed from Chandler to Dalton to Sherry who was on dry land. At one point, Sherry screamed because she thought the turtle would bite her. Chandler reassured Sherry that the turtle could not bite her because she was handling it correctly. The educational researcher asked Larry to use the Android to take pictures of participant activities, and Larry readily complied. When Dalton and Chandler waded to the fourth trap, Dalton reported that it was empty. The group skipped the fifth trap and moved directly to the sixth trap. While on the way, they speculated about the species of the largest turtle from trap three. Chandler guessed that it was a Yellowbelly Slider. Dr. W said that was her first guess and Sherry said, “It’s something that tries to bite people, that’s all I know.” Erin and an assistant project leader donned waders and checked traps six and seven. The assistant project leader found a dragonfly nymph while checking trap six, and asked the group if they wanted to see it. Dalton replied, “Yes ma’am, can you bring it up here?” The educational researcher laughed at Dalton telling the assistant project leader to bring the larva to him, and Dalton said to the educational researcher, “Don’t laugh, I can’t go in there. I ain’t never caught one of them.” Once the group had seen the dragonfly nymph, Dalton noticed several fish in trap six. Of the first fish examined, Dalton exclaimed, “Man, what kind of fish is that?” Sherry was curious about the fish as well. Chandler said it was a catfish, and Dalton agreed with him. A second fish was found in the trap; it was a sunfish. Dalton said he thought it was a bluegill, and asked Dr. W if a bluegill was a kind of sunfish. Dr. W showed the group a carp that had also been in the trap. Sherry wanted to know how to catch carp, and Dr. W said that carp could not be caught with a baited hook. Dalton said, “He’s like a vegetarian.” Dalton asked Dr. W if she fished, and she said she did. The last trap only had a single fish in it. The group went back to trap five which they had skipped. Two visiting teachers pulled this trap out of the water; it contained two turtles. Sherry took one of the turtles and Dr. W told her not to drop it; it looked like a new species. Sherry said she hadn’t dropped her last turtle, and Dalton immediately supported her, telling her she was cool.

The group moved to a shaded spot to process the turtle data. Dr. W divided the group into two subgroups: One group was Dalton, Erin and Chandler; the second group was Larry and Sherry. As was Dr. W’s practice, she ensured that each participant used every tool and all were involved in data entry. Dalton asked Dr. W what the “worm-like” animals attached to the turtles were, and she told him they were leeches. Sherry also noticed leeches on her turtle. Once Sherry and Larry had processed a turtle, Dr. W told Larry to take it back to trap three and release it. Dr. W told Dalton and Chandler to return their turtle to the water. Chandler, Dalton and Erin cooperated with Dr. W to identify their next turtle, which was an Eastern Mud Turtle. As this was the first turtle of this species caught at SCR, Dr. W gave Chandler, Dalton and Erin instructions on how to mark the shell, started the marks, and told the participants to complete the marking on their own. Chandler said that the new turtle species was found by a male participant, not a female participant. Sherry glared at Chandler and said, “He’s still talking smack.” Sherry and Larry continued to process turtles. Although Sherry had been obviously scared of the turtles earlier, she now processed them without fear.

The group finished processing the turtles and returned to the cafeteria for group story time. Larry was asked to tell the group story and he proceeded, “We was with the aquatic turtles today. We caught five fish, six fish, five turtles, I think?” Dr. W answered, “Six turtles.” Larry continued, “Six turtles, we caught a Mud Turtle and a Musk Turtle.” Dr. W corrected Larry and said that the Musk Turtle was caught the night before. Dr. W told the whole HRE group how to identify Mud and Musk turtles, and Larry engaged in this conversation. After all groups had told their stories, the HRE group went to lunch.

Thursday. The group moved to the snake hut for their morning study. Ms. M introduced the group to transects and cover boards as a method for capturing snakes and other herps. As Ms. M led the group out to check cover boards, she introduced them to the longleaf pine ecosystems they were walking through; she asked each participant to find a longleaf pine. Chandler was the first to find a longleaf pine. The group reached the first cover board, and Chandler turned it over and found no reptiles or amphibians. Ms. M said that although nothing was under the board now, there was evidence that something had been there recently. She asked the group what sort of animal they thought it might be, and Larry correctly suggested a mammal. On the way to the third cover board, Larry and Sherry found their longleaf pines. Sherry pointed out a spider web to

Chandler because she knew he was interested in spiders. Sherry lifted the third cover board and there was nothing of interest. After the third cover board, Ms. M had the group switch activities to turning logs to look for herps. After turning logs for a while without success, the group returned to the snake hut. During the walk back, Larry said, “Ain’t this a longleaf pine?” Dalton claimed the longleaf pine that Larry found as his own.

Once in the snake hut, the participants told snake stories. Larry told a story about killing a “chicken snake” because his family raised chickens. Dalton’s story was about his family stopping their car in order to rescue a black snake that was crossing the road. Sherry told a story about her young cousin who saw a snake at a family gathering at her house. The youngster was very upset and felt the snake was chasing him. When Sherry went to see the snake, it was only a foot or so long. Sherry said her cousin was “pitiful, screaming like a little girl.” Sherry finished her story by saying, “and they ended up killing it. And I was, ‘Like what did they kill it for?’” After their stories, Ms. M introduced them to snake anatomy, snake identification, and field guides that help to identify snakes. Ms. M talked about different species of snakes and also introduced the subject of venomous and non-venomous snakes. The group played a game called “Find the Copperhead.” Dalton was the first to identify the Copperhead, and said he could identify it because it had vertical slit-like pupils. Dalton added that young Copperheads had green tails and that this species did not lay eggs.

When Ms. M told the group it was now time to hold a snake, and Sherry agreed to hold one although she had previously said she was afraid. As Sherry held the snake, she smiled. Ms. M asked Sherry what she would do if the snake bit her. Sherry replied, “I would tell you to grab it." Ms. M said that would be the right thing to do. Ms. M allowed Dalton to hold a Banded Watersnake. After handling the water snake, Dalton gave the coiled snake to Sherry. Chandler thought the snake had bitten Sherry and chastised Dalton for causing the snake to bite. Dalton simply looked at Chandler and said nothing; both Sherry and a project leader said that Dalton had done nothing wrong. Sherry told Chandler that the snake had not bitten her and that if it had, she would have hit Dalton. Dalton simply smiled at Sherry's comment. Sherry gave the snake to someone else, and she and Dalton moved away from Chandler to look at the Corn Snake. During this entire event, Erin and Larry sat in the corner by themselves.

A few moments later, Sherry held a Ball Python. When the educational researcher asked the group what kind of snake it was, Dalton grinned and said it was a "Monty Python." Other participants said that Dalton was reading the snake's name off its box, and Dalton laughed knowingly. When asked if he would like to hold the snake, Larry replied, "I'm good." Dalton stroked the snake while Sherry held it. He turned to Larry and said, "Now you need to hold it." Dalton walked over to the corner where Larry was sitting and patted him on the arm. Dalton took a camera and took pictures of Chandler holding the snake; he took the camera to Larry and showed him the pictures. When asked if he would hold a snake, Larry said, "Nope. Those, they are too big." After the group had finished handling the python, Ms. M asked Sherry to return it to its container. Having returned the camera to its owner, Dalton moved toward Sherry. Chandler stepped between Sherry and Dalton, blocking Dalton's path. Dalton calmly put his hands on Chandler's shoulders and gently moved Chandler out of his way. Ms. M asked the participants to return to their seats in preparation for practicing snake capture techniques. Ms. M had a large Boa Constrictor that was to be held by the entire group and she talked about it as she prepared for the next activity. Larry expressed reluctance about joining in this group activity. When Ms. M told Dalton that she thought he would help hold the animal readily, Larry told Dalton, “I will be your supervisor.”

Ms. M used a tame California King Snake for the snake capture exercise. Sherry was the second participant to attempt this exercise. Following Ms. M’s instructions to throw a pillowcase over the snake’s head and then grab it, Sherry easily lifted the snake by its midsection. Dalton volunteered to go next, and Sherry calmly placed the snake on the floor for him. Dalton missed on his first try, and was chided by Larry, to which Dalton responded, “You do it, then.” Dalton’s second attempt was successful. Dalton held the snake in Larry’s direction and said, “Larry, are you going to do it?” When Larry replied in the negative, Dalton laughed at him. Sherry now attempted to return to her seat, but Chandler moved into her path. As Dalton had done previously, Sherry calmly put her hands on Chandler’s shoulders and moved him out of her way.

Ms. M brought out a Black Racer that had a bad reputation at the HRE because it had bitten the individual who captured it. None of the participants wanted to handle this snake. Sherry said, “I ain’t picking that one up . . . that’s the evil one.” One of the teachers assigned to the group asked to hold the snake. Larry, who was concerned the teacher might get bitten, told her to pick it up by its neck. Ms. M quickly said that picking snakes up by their necks was a bad idea, because this method might damage the snake’s head, and because this method upsets some snakes. Larry was interested, and was surprised to learn this fact. “Oh, you don’t?” he asked. While the teacher held the snake, Sherry overcame her fear and touched it while Dalton took a picture.

The group next discussed venomous snakes and what their heads look like. An assistant project leader stated that some non-venomous snakes could flatten their heads or necks in order to imitate venomous snakes. Sherry contributed, “I’ve seen a Hognose Snake do that before.” Larry had been sitting away from the group and was playing with a life-like replica of a Black Racer. Chandler approached Larry, grabbed the replica snake by the neck and poked it into Larry’s face. Chandler took the snake across the room and poked it in Sherry’s face. Sherry just looked at him. Finally, Chandler teased an uninterested Dalton in the same way. Ms. M mentioned that the group was running out of time. Larry surprisingly asked, “So we can’t hold the big one?” When the Boa Constrictor was brought out, the entire group held it except for Erin and Larry who moved to the corner of the snake hut. Ms. M asked the group to make room along the snake’s body so that Larry could help hold it if he wanted to. Larry stood, pantomiming exaggerated fear, and moved forward. Larry took his place and held the snake; however, he stood a step further from the snake than anyone else and was the first to release it.

After this activity, the group moved to the cafeteria for group story time. No Lumbee participant was involved in the report.

The Thursday evening activity was the talent show; the only Group 2 data recorded for this event was for Sherry, who sang a cappella. Dalton and Larry did not perform, but supported all performers enthusiastically.

Friday. The morning study for Group 2 was stream amphibians. The group moved outside the cafeteria to the first minnow trap station with Dalton and Larry in the lead. Chandler pulled the traps and Larry collected data on the group's paper data sheet. The group moved to the second trap station and Dalton found a spider in one of the traps when he pulled the trap. The assistant project leader thought it was some kind of insect nymph, but Dalton insisted it was a spider. The project leader said she had never seen such a spider in a trap before. Dalton noticed Larry was having trouble taking data with a pencil, and offered him his pen. Sherry pulled the traps at the third station, which contained only macroinvertebrates. Once the third trap station was processed, the assistant project leader informed the group that it was time to move to the fourth trap station which was located near the remote canoe site, a good 15 minute hike away. The group arrived at the small stream where the fourth trap station was located. Chandler and Dalton pulled the two minnow traps at the fourth site. The group found a water scorpion in the first trap that the project leaders wanted to take back to show during group story time. They needed a plastic bucket with water to keep the animal alive. Dalton had been in charge of the bucket and went to get it as he had left it a short distance away. Chandler immediately asked Dalton if he had left the bucket, and when Dalton replied in the affirmative, Chandler said in a mocking tone, "You left the bucket?" As Dalton went to get the bucket, Chandler continued to complain about Dalton's actions. Once Dalton returned with the bucket, the water scorpion and two small fish were placed in it. Larry had been taking notes the whole time, but he walked up to the project leader, handed her the clipboard with note sheets without comment, and walked away from the group. The educational researcher wrote in her field notes that she thought something had occurred to upset Larry. After a while, Dalton took a dip net and walked to Larry and handed him the net. Larry began dipping, found something in the net, and showed it to Dalton. Dalton carried the net to the assistant project leader who identified the animal as a mud minnow. Despite Dalton's efforts, Larry remained conspicuously separated from the group until they found an amphiuma in the second minnow trap. Larry immediately rejoined the group to see the unusual amphibian and resumed his task of taking data for the group on the paper data sheet. When the amphiuma was placed in the bucket with the other animals in order to be taken back for group story time, Larry was concerned for the fish in the bucket, "What about the fish? He won't kill the fish?" The assistant project leader told Larry that the animal was probably traumatized and would not eat anything. While the group discussed their good fortune at finding an amphiuma, Chandler approached Sherry and said, "You find nothing." Sherry responded, "I don't care, Chandler."

Once the amphiuma had been processed, the group started the long hike back to the cafeteria with Larry and Dalton in the lead. On the way, they stopped at the art building so that the project leaders could rinse off the minnow traps. The educational researcher used this time to have an impromptu interview with the group participants. The educational researcher asked Sherry what she thought of her HRE experience and Sherry said, "It's been awesome." Sherry was especially proud of holding the snakes; she listed their names, "Boa Constrictor, California King Snake, Corn Snake and Ball Python." When asked if she had overcome her fear of holding snakes, Sherry nodded yes as she used her shirt to wipe sweat out of her eyes. The educational researcher asked Dalton about his week. During his interview Dalton would not look at the camera, instead he looked at Sherry. When asked if he had a good time, he said, “It was good, all right.” The assistant project leader asked Dalton, “You boys don’t talk much, do you?” After a few more questions, Dalton said, “OK, that’s enough.” The educational researcher laughed and said, “OK, you don’t like to talk.” The educational researcher asked Larry if he could tell her anything about his week. Larry replied, “Nope.” Upon hearing this, Chandler whispered, “Antisocial.” The educational researcher responded immediately to Chandler’s comment, “What, maybe he is just smart.” When questioned further about whether he had learned anything new, Larry said he had learned to lasso lizards. Clearly tired of the interview, Larry simply answered “yep” to the rest of the educational researcher’s questions.

Once the group returned to the lake beside the cafeteria, they checked the last two trap stations, but they found nothing. The group entered all trap data into the iPads. Once this task was accomplished, they all donned waders and entered the lake with dip nets. While the group was putting on waders, the assistant project leader commented that Larry didn’t say much, but when he did it was worth listening to. Larry seemed to appreciate the assistant project leader’s comments and became more engaged. Sherry didn’t feel well, and remained on the shore and videoed the other group members while they used their dip nets. The three Lumbee participants bantered humorously the whole time the process was being videoed. Interestingly, they included the assistant project leader in their banter, and he joined in actively.

At group story time, Chandler and Erin presented the group story, and no Lumbee participants spoke. As it was the last day of the HRE, this was the last activity HRE activity for the day.

Group 2's Ways of Knowing and Being after the HRE

Dalton. The information for this self-portrait was gleaned from the interview (7/19/2012). Dalton was most proud of getting into the water during the aquatic turtle activity when he didn't know what else was in the water. He was not really scared. He was just not sure of what was under the surface. Dalton felt that he contributed to Group 2 by providing help "with whatever they needed." Specifically, Dalton felt that he "helped the man walk the dogs, and helped them pick up the cover boards today, and [he] helped them check the turtle traps." Dalton also explained his contributions to the entire HRE, "I helped SCR learn what kind of species they had. I helped other people learn about species and their characteristics." Dalton felt that he was able to make these contributions because he was good in science, which he defined as paying attention and listening. Dalton described himself during the HRE using the following three words: active, interested and determined. Dalton said "we were always doing something, we were always learning new things, and I was determined to learn new things when I came." Dalton said that the three smartest HRE participants were Nicholas, Carter, and Alfred. Dalton chose them as the smartest "because they knew their stuff about reptiles before they came. They were active and they were brave." Dalton felt he shared the characteristics of being active and brave. Dalton said that the HRE project leaders would describe him as "helpful." Dalton thought he had developed several skills during the

HRE that he would take home with him: “I learned to identify different species, to identify their sex, and what they are.” Dalton said that these skills would help him at his home because, “I know what types of snakes to pick up, like venomous or non-venomous.”

Larry. The information for this self-portrait was gleaned from Larry’s interview (7/19/2012). Larry seemed to dislike communicating his feelings and opinions to the interviewer. This made my analysis of his responses difficult. Larry was proud of his performance during the Box Turtle activities, and he was proud because he was the one “holding the dogs for the man.” Larry felt he was good with technology, had experience with technology, and he contributed to Group 2’s activities by loaning his expertise. Larry reported that he contributed to the entire HRE’s activities by “counting the new species,” and he described himself during the HRE as “fun, excited, and awesome.” Larry said, “It’s been fun here the last week; I’ve had fun… and it’s been exciting to learn different things and stuff.” Larry thought the HRE was awesome because “of the games and stuff that we have, activities.” Larry thought the three smartest HRE participants were Bonnie, Roger and Kyle. Bonnie was smart because she knew a lot of science, was always reading, and answered a lot of questions correctly. Roger was smart because, “When he goes into something, he’s like into it. He ain’t lost, like looking around, he’s always into it.” Kyle was smart because he knew a lot about science and was able to talk about the turtles before the group had worked with turtles. Larry did not think he shared any characteristics with the smart individuals; in spite of this, he felt HRE project leaders would think of him as “motivated.” While not listing specific skills or knowledge he had acquired during the HRE, he thought his HRE experiences would help him do well in science at school. He said, “Like when I go to school in science class, I’ll know more, be ahead of the class.”

Sherry. I gleaned the information for Sherry’s self-portrait from her interview (7/19/2012). Sherry said that she had been proud of holding the Boa Constrictor during snake studies that morning:

> When I held it . . . when I first held the snake I was scared it was going to start constricting, like grab my arm and break my arm, but I had to calm down and look because, like, the snake would flip out, so I just calmed down, and I held it, and it was just so exciting for me because I have never held a snake that big.

Sherry felt that she contributed to her group by using the Android to take pictures, record GPS coordinates, and record frog calls. She also helped her group catch animals. Sherry felt she had contributed to the entire HRE community by helping to find two new species that had not been seen during previous HREs. She felt she was able to help find these new species because she was “good with animals” and knew how to be quiet. Sherry described herself during the HRE as “excited, eager, and kind of scared.” Sherry was excited because “[I]t’s so different. You get to be like with all of the animals and stuff, and I love animals, and it’s just exciting because it’s something I’ve never done before.” Sherry was also “eager to learn about how they are, like how all the different animals are, and stuff, and like every animal has its own habitat and stuff.” Sherry was scared that a snake would bite her, even though she stated clearly that she wanted to be bitten for reasons she did not explain. Sherry identified Carter, Kyle and Daisy as the three smartest participants at the HRE. Sherry thought Daisy was smart because she know how to handle the animals better than the other participants because Daisy was calm when she handled them. Daisy was also already familiar with many of the animals the other participants first encountered during the HRE. Sherry felt Kyle and Carter were smart because they also were familiar with the animals at SCR before they came, and knew how to handle the animals. She felt this was especially true for Carter because he knew what to do when a snake was "freaking out." When explaining her characteristics that were similar to the three smartest individuals, Sherry felt she had come to understand how to calmly handle animals like Daisy, and how to identify and know animals like Kyle and Carter. Sherry felt the HRE project leaders would describe her as, "A cheerful, happy and smart person." When asked what skills or characteristics she had developed during the week that would help her when she went home, Sherry said:

> Like when you see a snake and you don't know what kind of snake it is, don't just like go and try to pick it up because it might be poisonous, and if it bites you, it will kill you or whatever. Like, make sure that you put the animal that you caught in the exact same place, because it has a home, just like you do. Yeah, make sure you put it back in its home.

Group 3: Gavin, Harold, and Tonya

Tonya, Gavin and Harold were the Lumbee participants in Group 3. Gavin was going into the tenth grade the following year; both Tonya and Harold were going into the ninth grade (see Tables 4 and 5). Non-Lumbee members of Group 3 were Daisy, Tinesha and Nicholas. Daisy (White, female) and Tinesha (African American, female) were rising ninth graders. Like Gavin, Nicholas (Asian/Pacific Islander), the group's a priori expert participant, was going into the tenth grade the following fall.

Group 3's Ways of Knowing and Being before the HRE

Gavin. Gavin described himself as smart and interested in school science. He was smart because he tried to be quiet and listen to the teacher. The previous year was Gavin's first year in high school, and he had found the new, different science content interesting. Gavin contributed to his school group's science activities by helping to answer questions if no one else knew the answer. Gavin thought his teachers would describe him as "nice." Gavin chose two females and a male as the three smartest students in his class. Gavin characterized all three of these students in the following way: "They done the same thing like the first one, studied more, and made good grades." Like those three other students, Gavin felt that he studied and worked hard to make good grades. Unlike him, Gavin thought the other three students talked more than he did and they were more "social."

Harold. Harold said he liked hands-on field activities better than school activities. He described his previous year in science in the following way: "I was good at science, I was getting As and Bs and stuff, and I was really, really good at it. That's probably the same as the first one, but that's all I can think about." He attributed his science abilities in part to popular culture. When he was little he watched the *Animal Planet* and other "sciencey" programs. Watching these programs convinced him that "smart people would become scientists one day." He thought if he were smart that way, he could become a scientist while he was little. He continued to watch science programming and he felt that he became "tied up into science, and [he] just kept on getting good at it, and ended up making As and Bs on all the science stuff."

Harold named Dalton and two other males as the three smartest students in his science class. Harold discussed characteristics of these three males and himself that he felt made them smart:

> Whenever they got in science class, they'd mess around like I would, and so the teacher started saying instructions, and they'd do that as fast as they could, and they'd get right back to playing around, some kind of motive for them. And I guess I did the same thing because I was in the same science class as them, and I just worked with them every day.

Harold contributed diagrams and artwork to school science groups, while others composed the text for group assignments. Harold said his schoolteachers would describe him as a "fun kind of person."

Tonya. Describing her performance during school science, Tonya said she helped to rephrase instructions that other students did not understand, and she helped to gather materials for the activities. Also, she defined herself as a good observer. Tonya listed three females as the three smartest students in her class. The first female was smart because she could answer the hardest science questions, and the other two females were smart in science because they could help Tonya if she had questions about science. Like these three females, Tonya thought she was smart and helpful.

When the interviewer asked how she contributed to group science activities in school, Tonya replied, "If it was like a science project or something, I think I could help find…well if we were building anything, I could help construct what we were building" Tonya did not always see herself as a leader. Rather, she described herself as a reflective learner (Pewewardy, 2002): "I kinda like to sit back and let somebody else do it, and then later on when I catch on, I can do it then." Tonya believed that her schoolteachers would describe her as "curious."

Group 3's Ways of Knowing and Being during the HRE

I observed Group 3 during the week of the HRE. Unless I state differently, the qualitative data that I present for Group 3's activities during the HRE derive from my field notes, my contact summary sheets, and my transcriptions of audio files and video files that I made during my observations of Group 3.

Sunday. Group 3 participants engaged in electives; Tonya and Harold cooperated with Sherry during the leaf litter activity. No data were collected for Gavin's participation in a Sunday elective.

Tonya was the quietest of the three Lumbee participants. Harold studied his litter box intently and said, "I've got a little worm thing in here." Sherry asked him if it was really a worm. Harold said, "I don't know, it looks like a kind of a caterpillar to me. Take a look." The elective leader suggested that the group take it back to the cafeteria to look at it under a microscope. Harold worried about the organisms, but the elective leader assured him they would be fine. At this point in the elective, one of the other participants shook his litter box for two minutes as instructed. While doing so, he whooped and danced like a movie Indian. The Lumbee participants ignored him.

After dinner on Sunday, participants engaged in an evening frog call hike. The participants were required to be in their group for this activity. There was no educational research data collected for Group 3 during this activity.

Monday. Group 3's Monday morning study was Box Turtles. The project leader introduced RJ and his Box Turtle hunting dogs to the group, and RJ introduced his dogs to everyone. The dogs were released, and Dr. N told the group that the dogs would move fast, and they would need to move quickly to keep up. Following the dogs, Harold and I talked. He told me that he hunted. Harold said he hunted deer and pheasants (his term for bobwhite quail). He was a good shot, and he could shoot pheasants on the wing when his dogs flushed them.

Harold said he did not have a trained hunting dog currently. He had owned them in the past, and was now training four puppies. Harold related that his puppies had turned up Snapping Turtles, but the dogs were wary of the Snapping Turtles and barked at them from a distance.

Harold said there were four ponds on his family property that they stocked with fish. He told about trying to remove a snapping turtle from one of the ponds because it was eating the fish fry. While Harold had been occupied telling stories, it was clear he was also monitoring the dogs, because he suddenly asked, "How did that dog get behind us?"

The group stopped at an outside spigot so that the dogs could be watered down which would prevent them from overheating. Harold pointed out to RJ that he thought the dogs had picked up a scent trail. RJ thought it was probably a squirrel because the dogs stopped looking around. Dr. N and RJ decided to move along to a different spot in hopes of finding a turtle. In order to keep the dogs close while the group moved to a new area, RJ leashed them and put Gavin in charge of them. The group moved to an overgrown, damp trail where the dogs were released because RJ thought it looked like good habitat. Dr. N asked Harold more about fishing on his family's ponds. Harold replied that he caught shell crackers, catfish and other fish that he didn't know. He said he always threw the catfish back because his family was trying to establish a breeding population.

RJ told the group that the turtles didn't seem to be moving because of the heat, and that the dogs might not find one. While RJ was saying this, one of the dogs walked up with a turtle in its mouth. The group was astonished; Harold said the dogs were awesome. The project leader showed them how to process the turtle, a big male with a damaged shell. All the Lumbee participants actively engaged in turtle processing. Harold was able to explain why the male turtle had a concave indentation on his plastron, "So he can sit up there." Harold was careful to explain turtle sex as politely as he could. Harold told the group that he had never found a Box Turtle before, but he had found a Painted Turtle in his grandmother's yard. As turtle processing was being completed, RJ asked Gavin to leash the dogs again, and Gavin was pleased with this responsibility. The group moved on and soon passed a large mud hole. Gavin allowed the dogs to cool off in the water while they were still on their leashes. RJ asked that the dogs be released to hunt again.

While the dogs hunted, Tonya talked about living in the country and gave her definition of what country meant: "Like many cars don't pass by and nothing around except trees, corn fields, bean fields, and everything like that." Tonya explained the differences between life in the country and city:

> There are a bunch of places in the country where there are bunches of open areas. You can go play in different places. And kinda like in the city, if you want to play baseball, you have to go pay for it. In the country you can just play for free, all day long.

Tonya's parents only allowed her in the woods when she was with someone, but being in the woods didn't bother her. Some frogs did bother her:

> I actually found frogs on my back door, and I was kinda terrified by one, one night. Because I didn't know what it was, you know, and it scared me. My little four year old sister picked it up. Picked up the frog, now. And I was like, "Oh my," because I was completely terrified because I didn't know what it was.

RJ decided it was time to leash the dogs and walk them back to the cafeteria. Dr. N was describing longleaf pine ecosystems along the way when the project director noticed a Black Racer sunning itself at the base of a tree. The project leader grabbed the snake, which bit her. The group talked briefly about the snake and the project leader put it in a pillowcase. Harold said he had found a black snake on his farm and wondered what kind it was. Dr. N told him it was probably either a Black Racer like the snake that was just caught, or a Black Rat Snake. Harold said, "Yeah, it was one of them, and it was HUGE!" Harold told a tall tale about killing the snake with a bush axe because the snake crawled toward him. The group carried the turtle and snake back to the cafeteria to be demonstrated during group story time. No Lumbee participant represented Group 3 during group story time.

Group 3's Monday evening activity was CASP. The Box Turtle project leader conducted Group 3's CASP walk. For a while, Dr. A joined the group. After listening at frog call stop one, the group could not agree on what they heard. Dr. A asked Gavin to explain the difference in the calls of a Green Tree Frog and a Green Frog. Gavin told her that the Green Frog “is like a banjo . . . and the Green Tree Frog, I forgot how it sounds.” Dr. A informed the group that she didn’t know a good way to describe a Green Tree Frog call. Although it was not possible to discern individual voices at stop one, it was clear that all participants were engaged in the process because they all were talking about what they heard. At stop two, Mr. R helped the group decide what they were hearing once the two minute listening period was over. Once again, the entire group was engaged. On the way to stop three, the group found a toad and identified it. Gavin said that he had been to science camps held at a nearby university, and he wanted to be a veterinarian.

After the group listened at stop three, they again cooperated to identify the species that they heard. When the two minutes ended at stop four, the project leader asked what everyone had heard, and Harold said jokingly, “skeeters.” Harold asked, “What is that bug over there making that noise?” I told him I thought they were katydids. Harold pointed out a baby cricket for the group. The group reached stop five. After listening there, Dr. A and the participants agreed that it was hard to hear anything but katydids, but Dr. A reminded them that they still needed to enter something into the Androids. The group reached the sixth and last stop. After listening, the group determined that they had heard a full chorus of Green Tree Frogs and a single Green Frog. Once it had been determined that all data had been entered into the Androids correctly, the group left for their cabins for the evening.

Tuesday. Group 3’s morning study was aquatic turtles. After Dr. W introduced the activity, the group left to check the aquatic turtle traps. Tonya and Gavin immediately picked up collecting buckets without being asked. During the walk to the first trap, Tonya confided to me that she had never worn waders. Nicholas and Tinesha checked the first two traps; there was no turtle in the first trap, but there was a hole in the mesh and a scute in the trap indicating that a turtle might have escaped. While the group discussed what might have happened, Harold worked with the Android. Gavin remained engaged and interested in the discussion while closely examining the scute. The group moved to the second trap site. While the group waited for the trap to be checked, Harold showed me a video that he had created on the Android. The video showed the group checking the first trap, and Harold had set the video to music. There were no turtles in the second trap, but there were two fish. While the group attempted to identify the two fish, the first one got away. Gavin correctly identified the second fish as a catfish. Gavin said he and his father fished from banks of the Lumber River every two weeks, and they caught catfish, red breast, bream and bass.

Gavin and Harold put on waders to check the next two traps. Harold joked as he donned his waders; Gavin accomplished the task quietly. Harold said, “I feel like I am going on an expedition.” Dr. W asked Harold and Gavin if they had worn waders; both replied that they had not. Harold quipped that he felt like the guy on *Dirty Jobs*. Once in the water, Gavin remained quiet, but Harold continued to talk to the group. There were no turtles in the third trap. Once the trap was re-baited, Gavin and Harold came out of the water and the group moved to the fourth trap. During the walk, both Tonya and Nicholas mentioned that Gavin did not talk or smile very often. The group’s teacher interjected that when Gavin did smile, it was from, “ear to ear.” While checking the fourth trap, Gavin remained quiet and Harold remained vocal. They found nothing in the fourth trap, and the two Lumbee participants came out of the water. Harold said that wading into the water while wearing waders "was a hard slog." Dr. W laughed, and told him he had done well.

Tinesha and Tonya donned waders to check the next two traps. They found a small sunfish in their first trap; Gavin said he had caught sunfish on the Lumber River. While the trap was being checked, Harold and Nicholas teased one another. The group moved on to the sixth trap, which contained nothing but sticks, which Harold told the participants to use to make a turtle. The group teacher and the assistant project leader retrieved the last trap that contained three turtles. After the participants and Dr. W extracted the turtles from the trap, they moved to the convention center steps to collect and record the necessary data. Gavin collected equipment without being asked, and Dr. W complimented him for his actions. Gavin merely smiled.

As the group began to process turtles, Mr. R arrived to help. The group worked together with Dr. W and Mr. R to discover three characteristics of the first turtle that identified it as a Yellowbelly Slider. Harold held a turtle that would be identified later, and he noticed "weird looking stuff" on its gums. Harold said that the objects looked like tiny teeth, and Mr. R said that often the beaks of these turtles were serrated to help them scrape and chew food. The group decided that the last two turtles were also Yellowbelly Sliders. Next, the group determined the sex of the turtles. Tonya said that male turtles would have a dent in their plastron, but Dr. W replied that this trait only applied to Box Turtles. Dr. W told the group that male Yellowbelly Sliders had very long front claws in order to grasp the shell of females. Harold wanted help determining the length of his turtle's front claws and asked, "Does this count as short or long, I really don't know?" After conferring with one another, Dr. W and Harold decided that his turtle was a male. Tonya correctly identified the second turtle as a female. Harold noticed that some claws were missing from his turtle, and said, "Missing some buddy, you've been fighting." Dr. W told Harold to be sure to note this fact on the data sheet. During processing, Harold made several humorous quips and asked several questions showing his engagement. He suggested that one turtle be coded MNT, standing for Mutant Ninja Turtle. Harold and Tonya collaborated to collect data for their turtle. Harold noticed leeches on the inside of the turtle's shell and asked what they were. Dr. W told him what they were, and that they should be left on the turtle.

Once participants collected data on the first two turtles, the groups prepared to file turtle scutes. In the first group, Daisy filed the first notch on one of the turtles. Harold filed the next notch; he was very cautious and asked Dr. W for directions twice. Tonya filed the final notch. In the second group, Tinesha filed the first notch. Dr. W helped Gavin file the second notch. When he was done, Dr. W said, "Excellent Gavin, excellent." Nicholas performed the final filing.

When it was time to release two turtles, Dr. W asked Harold and Nicholas to take the turtles to their capture site and release them. Harold released his turtle on the bank, but it did not move. Concerned for the turtle, Harold said, "Go free, turtle." He said, "Mine won't go." He picked the turtle up and moved it closer to the water. When the turtle finally moved into the water, Harold said, "There she goes, there she goes."

The last, largest turtle needed to be processed and released. Nicholas and Harold worked together to accomplish this task. Dr. W asked the group who had muscle and Harold said that he did. Dr. W asked him to file the big turtle's thick shell, which he did. The participants released the turtle back into the water when Nicholas and Harold finished marking it. Dr. W said the group had done well, and it was time for lunch. The group headed back to the cafeteria for group story time. No Lumbee participant was involved in telling the group's story.

Tuesday night's activity was evening electives. Harold chose the art elective, while Gavin and Tonya chose the snake bone jewelry.

Harold worked alongside Aaron in the art elective. Aaron made Two Chains, the snake, out of Model Magic. Harold made a drawing of the snake that Aaron created. Harold was quiet most of the time, but Dr. A asked what he was making, he responded, "I'm making the same thing as him (referring to his drawing of Aaron's model snake), but mine is black."

Gavin and Tonya were at the next table, where Gavin was as quiet as he had been during the morning's activities. Tonya was talkative and actively engaged in the participants' discussions about family relations. As Aaron and his snake dominated the evening art elective, no more data was collected concerning Lumbee participants from Group 3.

Wednesday. Group 3's morning study was snakes. Ms. M gave the group an overview of the morning's activities and said that the first activity would be a hike to check cover boards for snakes and other animals. As Ms. M described how to lift a cover board, she reminded the group never to pick up a snake up unless . . . and Tonya chimed in, “You know what it is.” As we walked to the cover board site, Gavin told me he sometimes saw snakes at home. I asked him if his family killed snakes or left them alone. Gavin replied that his family left snakes alone unless they were “pilots.” I asked Gavin what a pilot was and he replied, “It’s a snake that’s venomous.” While we walked, the group shared stories about farm animals and pets. Harold and Nicholas joked with one another. Ms. M asked if anyone had a spider story. Harold and Nicholas shared a story about a spider they had found in their cabin that morning; it was a female with babies on her back. Harold said he stepped on the spiders because he and Nicholas did not want spiders in their cabin. Ms. M talked to the group about longleaf pine ecosystems and their importance in the southeastern United States. She also pointed out that the longleaf pine is the state tree. Ms. M tasked each member of the group with finding their own longleaf pine before the group returned to the snake hut. Although all participants worked cooperatively to look under the cover boards, no animals were found. During the cover board search, Gavin was the first participant to find a longleaf pine. A little later, the group found a funnel-web spider web. While the group examined the web, Harold said that he had seen many of these webs at his home. He took a pine needle and agitated the web. The spider came out of its lair and the group was able to see it.

Harold was impatient and wanted to return to the snake hut to see the snakes, particularly the Ball Python, as he had seen one on *Animal Planet*. The conversation turned to swimming, and Harold said that he swam in the ponds on his farm; he preferred one particular pond that was spring fed and had no fish. When I asked him how his family kept fish out of the spring-fed pond, Harold said that this pond had to be stocked with fish, as it was not connected to any streams or rivers.

After the cover board search was completed, the group walked back to the snake hut. On the way, the group stopped at the bath houses for a restroom break. At the bathhouse, the group began a conversation about what sorts of things grew on farms. Harold said his dad grew hay, which he sold as horse feed. He described the bailing process. Tonya didn't live on a farm, but she and her mother helped Tonya's aunt with her garden. She told about a recent day when they all worked from seven in the morning until eleven at night to pick, shuck, and blanch corn to prepare it for freezing. Tonya said she also helped to grow collards, butter beans, cabbage, tomatoes, and sometimes watermelon.

Once in the snake hut, the group began telling their snake stories. Tonya was first to tell her story, and calmly related it to the group. Ms. M continually interrupted Tonya because she could not understand what Tonya was saying. The story was as follows: One day Tonya and her little brother went to a shed to get dog food. While they were getting the food, an old television fell over and revealed a Green Snake. Tonya said the snake was curled up and she thought it was dead, but her brother said it wasn't. Tonya sent her brother to get her mother, who came and killed the snake.

Harold told a brief story about encountering a black snake on his family's property. Although Harold could not differentiate one species of black snake from another two days previously, he specifically called this snake a Black Racer. Harold said that he was very young at the time and thought the snake was trying to kill him, but the snake simply crawled away.

Gavin was the last participant to tell his snake story, which he told in an extremely soft voice, “We was in the house, and…um it was a big snake, and it crawled through the chimney.” Gavin went on to explain that the snake had crawled down the chimney into the house. The event happened a long time ago when he was little. His mother got the children out of the house, while his father caught the snake and took it outside. As with Tonya, Ms. M had a hard time understanding Gavin.

Ms. M talked for a while about snake biology and conservation, and then prepared the group to handle a snake. Ms. M told the participants to sit by the container of the snake they wanted to hold. Harold was the first to get out of his seat and go sit by a snake. Harold readily picked up the snake he chose. Tonya approached Harold and his snake, reached out and touched it, but politely refused to hold a snake by herself. Gavin didn’t pick up a snake either, but touched the snake that Nicholas held.

The group learned more about snake anatomy, venomous snakes, and snake identification using field guides. They then played the “Find the Copperhead” game. Once the game was completed, it was time for the group to hold the Boa Constrictor. Once Ms. M and the assistant project leader took the Boa Constrictor out of its cage, she emphasized the snake was heavy and needed support. Harold was the first participant to reach the snake and he handled one of the thicker portions of the snake. Following Harold’s lead, the other participants held a portion of the snake, including both Tonya and Gavin. As someone else held most of the snake’s body, Gavin could only hold the snake's tail with one hand. I commented to Gavin, "You have just the tail." Gavin simply grinned and said nothing while Tonya laughed. Ms. M said, "Say Boa," as a group picture was taken. At this, Harold grinned, Tonya laughed, and Gavin gave one of his now-famous smiles.

At group story time, Tinesha and Tonya cooperated to tell Group 3's story. Tinesha described the cover board activity, longleaf pine ecosystems and holding the Boa Constrictor. Tonya said, "The Boa Constrictor was like my first snake I ever held." When finished, Tonya graced the group with a beautiful smile and a bow. Looking for the term "tar heel," Dr. N asked what the nickname for people from North Carolina was. Harold yelled out, "Lumbee."

Thursday. Group 3's morning study was stream amphibians. I joined the group twenty minutes late due to a meeting I attended. When I arrived, the group was busy checking minnow traps at the first trap station. The project leader and the assistant project leader had already pulled the first minnow trap, which contained a small bass. The project leader asked the group to check the leaf pack for animals. The group was not interested in this task, and they found little. Harold often spoke for his group, and he asked humorously, "Is there supposed to be something in there?" Harold quickly became disinterested in sorting through the leaf litter and picked up the Android and began videoing the group. Tonya volunteered to fill the sample bucket with lake water for the few animals that were found. The assistant project leader asked for a volunteer to pull the second minnow trap at this station; Gavin, who had been quiet, immediately volunteered. The group found nothing more at this station, and they moved to the next trap station. The participants were still reluctant to sort through the leaf pack, and the assistant project leader said he wanted everyone involved in this activity. Although they complained, the three female participants searched through the leaf pack; the three male participants did not contribute. Harold pointed to campers playing in the lake and said, “The only science I like is what they are doing.” When one of the female participants told Gavin to help them, Gavin and Harold began going through the leaf pack. The group found a small red worm and attempted to identify it using their visual insect keys. Nicholas pulled the first minnow trap that contained nothing. Harold insisted on pulling the next trap. He said he had been videoing the morning activities and wanted a turn pulling traps. There was nothing in the second trap when Harold pulled it out of the water. The group moved to the third trap station, and the camp counselor pulled the first trap. Tinesha volunteered to pull the second trap, which contained a fish that the group examined and released. Harold asked how the animals could get into minnow traps, but not get out. The assistant project leader told the group how minnow traps worked. The leaf pack for this site had been lost. The group moved across the wetland bridge to trap site four. Once there, the group pulled the leaf pack and laid it on the bridge for inspection. Again, participants were reluctant to search the leaf pack, but Tonya was the first to begin looking for animals. The assistant project leader encouraged the male participants to help Tonya, saying that the female participants were making the males look bad. Gavin and Harold helped Tonya examine the leaf pack; nothing important was found. When the project leader asked Gavin to pull the first minnow trap, he simply said “Yeah,” and calmly did what he had been asked to do. The trap contained a dead fish and

Harold worried that it had died because, “It got stuck in there too long.” Harold told the group that the good news about the morning’s activities was that, “We got a lot of duckweed today.” He pulled the second trap, but it contained nothing. The group moved to the next trap site.

As the group walked to the next station, Gavin talked to me about his personal Box Turtle study. I asked Gavin if he found Box Turtles along the road. Gavin related that sometimes he found the turtles along the road, and sometimes his father brought them home. He said he would keep the turtles for five days or so and then return them to where he had found them. When I asked if he would now start marking them as he had learned to do this week, he said yes.

The group arrived at the next station and the project leaders requested that participants to go through the leaf pack. When the assistant project leader said that Tonya was not helping with the leaf pack, the group teacher informed him that Tonya was recording data for that station. The group found a damselfly nymph in the leaf pack and identified it using their visual keys. Harold complained that he had yet to find anything in a leaf pack. The assistant project leader complimented Tonya on her data entry technique. Daisy pulled the first minnow trap at this station; it contained a sunfish and a damselfly nymph. Harold pulled the second trap, and there was nothing in the trap but the chicken used for bait. Harold said, “Another little chicken.” He told the assistant project leader that he needed to fry the chicken because fried chicken was what the animals wanted. The group moved to the last station. Once at the station, the assistant project leader retrieved the leaf pack and tossed it to Tonya, who opened it and spread the leaf pack for examination. The group again had to be encouraged to perform this task. Tonya found a snail while searching the leaf pack. Gavin entered this find on the group data sheet. The assistant project leader asked Gavin to pull the first minnow trap; there was nothing in it. Daisy pulled the second trap. This trap contained many diving beetles. When Daisy said she was “drawing the line” at touching diving beetles, Harold asked her how many lines she was going to draw. He gave her a stick and told her she could use it to draw her lines. Harold kidded Daisy that she would hold a python but not touch a diving beetle. The group moved back to the cafeteria and entered their data into the iPads. When given this task, Harold said that he hated paperwork. Although complaining the whole time, Harold worked with the assistant project leader to accomplish this task. Meanwhile, Nicholas and Tonya played Tap Tap Ants on the iPads.

The group donned waders and started dip netting in the water near the wetland bridge. Gavin and Tonya were quietly industrious, and the group joked with one another about swamp monsters. Harold was vocal while in the water. He continually told the group what he found: a fish, grass shrimp that he showed to everyone, and a dragonfly nymph. Harold caught a school of tiny fish and asked the assistant project leader if that was what the assistant project leader called minnows.

As the group was finishing its morning activities, I interrupted a conversation between the female participants. Tonya was talking about the talent show that would be held that evening, and related that she was a participant in the Miss Lumbee pageant. Tonya said she would be doing the routine that she performed in this pageant as her talent at the talent show that evening.

Harold and Nicholas told Group 3's story during group story time before lunch. Nicholas presented what had been found in the leaf packs and minnow traps. Harold talked about dip netting. Harold told the whole group that Group 3 had put on "water suits" and had gone dip netting to see what they could catch. Harold talked about what the group had caught, and said he had caught a big sunfish. Harold and Nicholas received a cheer from the group, and Harold told Nicholas, "We're like the best . . . we was like the best up there."

Thursday night's HRE group activity was a talent show. Gavin did not participate but was quietly supportive of everyone's performance as an audience member. Harold danced with other male participants from his cabin. Tonya performed her Miss Lumbee pageant dance routine; she clogged to contemporary jazz music.

Friday. Group 3's morning activity was lizards. The activity started in the cafeteria where the project leader gave an overview of the morning activities. Tonya was paying close attention along with Gavin. Harold was playing with an Android. The project leader called Harold out in order to re-engage him; the other participants chanted, "Bad, bad, bad." The group used lassos to practice catching plastic lizards in the cafeteria. Harold and Gavin practiced lassoing together.

Once practice was over, the group prepared to leave for the field. The group crossed the wetland bridge. Harold used the Android while he searched for lizards, but he was not videoing as he has done in the past few days. While Harold remained engaged with the Android, Gavin intensely searched the bushes for lizards. Tinesha and

Tonya worked together; Tonya repeatedly disturbed the leaf litter with her lasso in an attempt to scare lizards out into the open.

The group reached several storage buildings along the SCR main road. About this time, Tonya and Daisy spotted a lizard that they thought was a Ground Skink. Daisy captured the animal by hand; in the process the lizard dropped its tail. The group talked about this escape mechanism for a while. The group marked the lizard's location so it could be returned after processing in the cafeteria later that day. The group continued their search along a road that led back to the cafeteria. During this walk, Tonya told me, "I can deal with the lizards." When I asked if she had picked a lizard up, Tonya said that she hadn't; she was still trying to find one. Tonya went on to say that she might pick one up if she found one. Harold was separated from the rest of his group, still engrossed with the Android. When Harold rejoined the group, I asked if he had seen any lizards. He replied that he thought the lizards had gotten smart and moved back into the woods where they could not be seen.

In front of the camp offices, a camp counselor for the group lassoed a lizard, and Harold expressed frustration at not being able to find a lizard. I reminded him that he had been watching the Android and not the trees. He said that he had actually been looking for lizards for some time. The group marked the spot where the lizard was caught, and placed the lizard in a box to be processed later in the day. When the female participants ribbed the males because the females had caught all the lizards, Harold responded. "I am depressed, I can't handle it anymore." When I asked him why he couldn't handle things anymore, Harold said the he was out in the hot sun and not catching anything, "It's like an evil game of hide and seek." Harold said catching lizards was easier at his grandmother's house because the lizards came inside her house and sat in the windowsills.

The project leader took the group inside the camp office to see a Leopard Gecko. She took the animal out of its cage to let the participants handle it it if they wished. When Harold held the gecko, he told the group he could feel its heart. Gavin held the gecko next, quietly studying the animal but saying nothing. Tinesha held the animal, and then Daisy. While Daisy was holding the gecko, the project leader asked Tonya if she wanted to hold it. Tonya said no, but reached out to touch it. Daisy began to hand the gecko to the project leader, but Tonya interrupted and politely asked to hold the animal. Daisy handed the gecko to Tonya who then calmly held the lizard; Harold supported Tonya, saying this was probably her first time holding a lizard. When the project leader told Tonya, "Great job," Tonya smiled.

The group returned to the field, and Daisy soon spotted a lizard. Daisy, Harold and the project leader discussed the best way to catch the lizard. The entire group began debating how best to catch the anole. While the rest of his group debated Daisy and Harold's best course of action, Gavin simply lassoed the lizard. As Daisy helped the project leader extract the lizard from the lasso, I reminded Gavin that he would have to tell the group's story before lunch. Harold added, "And brag about it." Nicholas said, "Hey Gavin, one for the boys." The group praised Gavin for his capture, but Gavin never said a word.

The group moved down to the camp store to look for lizards. The project leader wanted to get the anole count for the week into double digits; it was standing at nine. Tinesha caught the tenth anole. While the animal was being processed, Harold called it a "little dinosaur." Harold said that he had learned from *Animal Planet* that sharks and alligators had been on earth since the time of the dinosaurs. Harold went on to say that it would be cool if people could clone dinosaurs in a manner similar to *Jurassic Park.*

The group returned to the cafeteria to process the captured lizards. The project leader reminded them of how to use the tools. She asked the group how to get a proper weight of a lizard in a bag; Tonya quickly gave the correct answer. The participants were divided into three groups of two in order to process the lizards they had caught. Harold and Nicholas collaborated closely in order to get their lizard out of the box. While working with his lizard, Harold noticed that Tonya and Tinesha were about to lose their lizard, and gave them a warning. Meanwhile, Gavin and Daisy's lizard did escape. Harold volunteered to catch the escaped lizard, did so, and returned it to Gavin and Daisy. When Harold caught the lizard, he told it to calm down, and Gavin petted the lizard in an effort to calm it. Harold remained extremely engaged in the data collection process, asking numerous questions to make sure data were entered correctly into the iPads. Tonya was also very engaged in the data collection process and asked numerous questions in a manner similar to Harold. Once Harold and Nicholas and Tonya and Tinesha finished processing their lizards, Harold and Tonya collaborated with the camp counselor to finish processing the lizard the counselor had caught. Harold was very engaged, and directed others during this process. Once all lizards were processed, the project leader said she would return them to their capture sites at a later time. The group made their own lassos to take home with them. Once this was done, the participants left for group story time.

Harold, Gavin and Tonya represented Group 3 during group story time. Gavin quietly recounted how he lassoed the lizard, all the while shifting his weight from leg to leg. Gavin said, "We had lizards today, and we um got some lassos, and we went out and tried to lasso some lizards, and I think we lassoed five. I lassoed one, and some others did too. And we got to hold a leopard gecko and some other lizards." As he finished, Gavin smiled and stepped back. Harold and Tonya escorted Gavin back to the circle of participants. Harold and Tonya had supported Gavin, but had managed to say not a word.

Group 3's Ways of Knowing and Being after the HRE

Gavin. The information for this self-portrait was gleaned from the Gavin's interview (7/19/2012). Gavin was proud of his performance during the Box Turtle activities. He felt good about himself because he was able to answer a lot of the questions the project leader asked during her introduction to the Box Turtle study. Gavin was proud that RJ allowed him to lead the Boykin Spaniel that was not hunting. Gavin explained his special pride by saying of RJ, "When he let me walk the dog, he really just let me do it. Nobody else did . . . no other campers."

Gavin believed that he contributed to Group 3's activities because he "was really active and done a lot of stuff." Gavin defined doing a lot of stuff as "getting in the water and take out the turtle traps and stuff like that." Gavin did not document any contribution that he felt he had made to the entire HRE. However, he did relate what he had discovered about himself during the HRE: "That I knew a lot about reptiles. I really knew a lot. I didn't know I knew that much."

Gavin reported that at the beginning of the HRE he was scared because "My daddy made me come. I really didn't want to come or nothin.'" However, Gavin reported, "I got interested, and I liked it. It was good." Gavin thought that Carter, Roger and Thomas were the three smartest HRE participants. Gavin felt that these three were smart because they were able to identify the animals they found right away. Gavin believed he had the most in common with Thomas as "He's kinda quiet too, and searches around for stuff." Gavin thought that the HRE project leaders would think he was "interesting." Gavin felt that his HRE experience had helped him to develop the skills to "be more social, interactive in school, stuff like that."

Harold. The information for this self-portrait was gleaned from Harold's interview (7/19/2012). Harold was proud of his activities and explained his pride as follows:

> The thing is, that one we did this morning, the stream salamanders, when I caught a lot of fishes and stuff, and nobody else did, like the shrimp, that nobody else did until late when we were about to leave.

Harold felt he contributed to Group 3 as he would take all "the pictures, and take the stuff down." Harold did not talk about "his" contributions to the entire HRE; rather he described "our" contributions

> Most of us caught new species that we didn't know that we had here. And some of them caught some stuff, like some turtles and stuff, that we didn't mark or anything, so we got to mark those to make sure we had some out there.

Harold's explanation of how the HRE contributed to the study of reptiles and amphibians indicates his understanding of mark-recapture techniques: "So, if we want to go back and find that turtle, then we can, and then study its habitats and stuff, and figure out what it does."

Harold described the HRE as awesome, cool and fascinating. The HRE was awesome because, "We get to go around and catch a bunch of animals and stuff." Harold said the HRE was cool because he got to get in the swimming pool and cool off. Harold thought the HRE fascinating because, "Most of the stuff I didn't know when I got here, so I actually learned a lot."

Harold initially said that everyone was smart. Upon reflection, Harold said his choices were Dalton, Larry and Kyle. Harold knew Dalton was smart, because he went to school with him. Harold noticed that Larry was smart during the HRE. Kyle was smart because, "He like knows how to catch stuff, sometimes without even trying." Harold felt that he shared some characteristics with these three as "They are all brave about what they are doing, and they follow instructions a lot, and they know how to have a good time." Harold felt the HRE project leaders would think of him as "smart." Harold felt that he had developed skills during the HRE that would help him when he returned home. His list of skills included "how to get snakes, like the plank and the snake hook stuff, and how to set those turtle traps." Harold elaborated about what he had learned about snakes at the HRE: "Yeah, I think I learned a lot about them so I can tell which ones are venomous and not, and which ones I should leave alone if they are, and what to do if I accidentally walk up on one, and a bunch of other stuff like that."

Tonya. The information for this self-portrait was gleaned from Tonya's interview (7/19/2012). Tonya was proud of herself during the aquatic turtle activities:

> When we got in the waders, and we had to actually go in the water and pull up the turtle traps. And so, when I stepped in the water, I actually slipped, but then I caught myself. So I'm actually proud of myself that I really got in the water.

Tonya explained how she contributed to Group 3's activities at the HRE by saying, "For instance, this week, when we were doing the aquatic turtle part, I was doing the measurements of the turtle, and how much they weighed. I was doing the length, the width and the height." Tonya thought she had contributed to the entire HRE's activities by catching animals. When the interviewer asked Tonya what skills she had that allowed her to catch animals, Tonya said:

> I think you have to be very quiet, and you have to be gentle….And if you do catch an animal, you have to make sure when you catch it you hold it right, or if not the animal will be uncomfortable.

During the HRE, Tonya felt she was "brave and curious." She substantiated her bravery by saying, "Because I am scared of snakes, and I finally held a snake this week." Tonya described herself as curious in this way: "I just wanted to learn more stuff, about turtles in particular, because I knew nothing about them, and I didn't know how to tell the difference between them." The interviewer asked Tonya to think of one more word to describe herself, and Tonya responded, "I helped others sometimes…like today with iPads, we had to give information about what we caught in the traps today. And Tinesha didn't know how to do it, so I helped her." Tonya thought Roger, Cole, and Cameron were the smartest HRE participants. Tonya thought these individuals were smart because they correctly answered the HRE project leaders' questions, but she did not think that she shared any characteristics with them. Tonya thought the HRE leaders would describe her as brave. Tonya thought that during the HRE she had learned skills to help her become a quiet observer of nature. She had learned some of these skill during the night hikes as "Ms. M told us when we were out in the woods in the dark; we had to be very quiet so we wouldn't scare away anything."

Qualitative Conclusions

General

I gathered qualitative data from several sources: participant HRE applications, participant application essays, participant letters of recommendation, educational researchers' field notes and contact summary sheets, and transcribed audio and video files that documented Lumbee participants' activities at the HRE. I used these qualitative data to address my research questions. This qualitative approach allowed me to make insights into aspects of individual participant's FoK and contributions to the HRE that were not accessible with the quantitative information.

Qualitative Findings That Can Be Used to Answer Research Questions

Below, I discuss my qualitative results for the Lumbee participants as a single group in order to address my research questions from a general perspective.

Research Question 1: What FoK Did these Lumbee Youths Bring to the SCR CoP?

Generally, my definition of FoK is centered on the concept that an individual's competence is founded, in part, on the knowledge gained through their life experiences.

Further, an individual's habitus or dispositions allow the individual to strategically use this knowledge. Thus, my analysis of the FoK of Lumbee youths includes not only what they knew, but also how their dispositions allowed them to be competent members of the SCR CoP. In general, the Lumbee participants' FoK can be categorized as either ways of knowing or ways of being. Building on this general concept, I developed three major themes of FoK used by the Lumbee participants: Ways of knowing about science or natural history, Ways of being a community member, Ways of being a Lumbee (see Table 8). Each of the three themes was related to subthemes that I documented based on my coding procedures (see Table 8). Taken together, these themes and subthemes represent the framework for my analysis of the FoK brought to the SCR CoP by the Lumbee participants. To be explicit, Table 8 represents my research findings concerning the FoK brought to the HRE by the Lumbee participants; my coding process revealed these FoK.

Research Questions 2 and 3: How Did these Lumbee Youths Come to Have These FoK and How Did They Leverage Them?

The subthemes I developed (see Table 8) are essentially the sources of Lumbee participant FoK that my coding protocol revealed. I will list these for each of my three major themes.

Theme: Ways of knowing about science or natural history.

Subtheme: Place-based knowledge or skills. I found that most of the Lumbee participants learned about science or natural history in a place-based way. Many of them exhibited place-based knowledge or skills that derived from their home or community, specifically hunting or fishing, agricultural practices, and travel. Aaron came to the HRE with knowledge about lizards based on searching for lizards around his home. Aaron recounted a story of his uncle hanging a lizard on his ear. During the snake dissection elective, Larry exhibited place-based knowledge about dressing and skinning deer with his family. Dalton exhibited place-based knowledge about walking outdoors after dark, because he had to do so at home to assist with his family's business. Harold had knowledge of the life history of Snapping Turtles derived from agricultural practices of his family who was trying to manage commercial fishponds. Larry was able to reassure RJ that there were no alligators in the SCR lake due to his specific knowledge of their distribution in southeastern North Carolina. Larry gained this knowledge as his family traveled away from home to fish.

Subtheme: Knowledge learned through informal science education. While some of the Lumbee participants gained FoK in this manner, only two Lumbees discussed this specifically. Barry told a story about visiting a snake farm during a general discussion that occurred during the snake dissection elective. Although Barry was normally quiet, his story added much to the activity. Harold spoke of holding snakes at a zoo during the snake studies activity. This experience allowed him to hold the snakes during the HRE with minimal concern.

Subtheme: Knowledge learned through popular culture. During group activities, Aaron and Harold would often talk about things they had learned on *Animal Planet*. Jewel wrote in her application letter that she read books about science voraciously and supplemented her school science learning with Internet searches. Harold related knowledge from the movie *Jurassic Park* during a discussion of lizards.

Theme: Ways of being a community member. The subthemes discussed below represent ways of being and I believe they result from an individual's disposition or habitus. A participant's disposition and habitus are acquired through their lived experiences within their home and community. Therefore, I cannot necessarily discuss the derivation of the subthemes, but I can discuss how participants leveraged them.

I found that most Lumbee participants came to the HRE well equipped to function in group activities. Uniquely, they conceived that effective group members could be self-assured, quiet, helpful participants. Although one or two were active vocal leaders, as a group the Lumbee participants did not feel that being vocal was necessary in order to be good group members.

Subtheme: Being a good group member. Without exception, the Lumbee participants were good group collaborators. In particular, Gavin and Tonya were helpful and often performed tasks without being asked. Aaron and Harold used their senses of humor to build community on many occasions. On several occasions, an educational researcher reported specifically on Jewel's polite engagement. Aaron was a community builder and he used these skills to help himself and other group members have a good time. Gavin, Dalton, Tonya and Jewel all participated in a self-assured manner. They were often quiet, but they were engaged and responded readily when asked. They never sought to draw attention to themselves in a manner that would disrupt group activities. Dalton and Larry were leaders, and they often led the way during field activities. Barry, who seemed to be shy and retiring, chose to engage in the community's activities by being a follower. The Lumbee participants were, on average, brave in outdoor settings. Gavin, who had been told to come to the HRE by his father, participated in all activities fully even though he was intimidated by many of them. Tonya said in her application essay that she was afraid of snakes, but held snakes nevertheless. Both Dalton and Gavin possessed a strong work ethic. Dalton often ensured that other group members performed their assigned tasks in a timely manner. Although Gavin had been made to come to the HRE, he was always an active participant during group activities. Both Aaron and Harold shared stories to facilitate group camaraderie.

Subtheme: Being a community science learner. Many of the Lumbee participants were curious and leveraged their curiosity to turn group discussions to the objects of their curiosity. Harold modified a discussion of lizards to the subject of recreating dinosaurs from their DNA in order to understand more fully whether this was possible. Barry was often characterized as disengaged, but during the snake dissection, he leveraged his curiosity in order to learn as much about snake anatomy as he could. This led him to the discovery that his snake had eaten a bird, a fact that he shared with the entire dissection group. The Lumbee were very observant when pursuing their activities. During the Box Turtle study, Larry was extremely engaged and observant, particularly as regarded the wellbeing and whereabouts of the turtle dogs. At one point, he observed the dogs being on a scent trail and pointed this fact out to RJ, who immediately paid closer attention. When tasked with finding a longleaf pine during snake studies, Gavin immediately began to survey his environment and became the first member of his group to find this tree. The tree Gavin found became the centerpiece of further discussion of this species. The Lumbee participants frequently displayed love or empathy for animals. Aaron disrupted the data processing of aquatic turtles because he was afraid that marking them might hurt them. He leveraged his concern to promote a group discussion of whether this was so. Larry was concerned that his aquatic turtle would not reenter the water when released. Dr. W had to repeatedly call him back to turtle processing until his turtle finally entered the water. The Lumbee participants readily used scientific tools and electronic technology in order to promote the goals of their groups. Generally, the Lumbee participants were engaged in all group activities, and this was especially so in outdoor situations that dealt with animals. Generally, their engagement allowed group activities to proceed smoothly. As a rule, Lumbee participants did not have to be prodded to perform group tasks assigned to them (with the possible exception of sorting through the leaf packs). The Lumbee participants told many stories about nature and animals in order to enrich group discussions of reptiles and amphibians. During the lizard activity, Sherry told that her father had shown her how to get a lizard to bite her earlobes so she could wear the lizards as earrings. When Dr. A brought a sassafras branch into the Sunday snake jewelry elective, Jewel added to the discussion by recounting a story about how her grandfather would always serve her sassafras tea when she did not feel well.

Subtheme: Being talented or having an interest. One talent that some Lumbee participants exhibited was storytelling. Aaron was an exceptional storyteller, and got the entire CoP involved in the *Saga of Two Chains*, a story he created about the model snake he made during one of the electives. Aaron repeatedly leveraged this talent to build community, as his stories were often about or required input from other participants. Aaron told researchers that storytelling was an important practice employed by his father and uncles. Harold told a variety of stories concerning his family and their adventures in nature in order to add to group discussions.

Several of the Lumbee participants had artistic talents. Harold was a good artist and had an interest in technology. As Aaron sculpted Two Chains the snake, Harold drew a picture of the same species. This collaboration with Aaron drew him into Aaron's story about Two Chains. Harold used his interest in technology in order to use the Androids to video his group's activities. Larry also had a strong ability and interest in technology; he said that this ability was his main contribution to his group. At one point, Harold set his group's activities to music, making a sort of video that enhanced the group's cohesiveness.

Tonya was a good dancer and performed her Miss Lumbee Pageant routine for the group during the talent show. Harold and Aaron danced with other male participants at the talent show while Sherry sang a song for the group. The talent show was an important vehicle for CoP bonding.

Theme: Ways of being a Lumbee. The Lumbee participants functioned as members of the Lumbee Indian community while at the HRE. Not only did they bring aspects of their culture to bear in the form of FoK, but they also exhibited coping strategies that allowed them to integrate with individuals of other cultures that were also present at the HRE.

Subtheme: Responding to stereotyping/discrimination. Throughout their history, the Lumbee have had to address discrimination or stereotyping of their American Indian identity. Within hours of their arrival at the HRE, Harold, Sherry and Tonya dealt with an incident that portrayed American Indians in a stereotypical way. These three Lumbee participants were engaged in the leaf litter elective on Sunday night. Roger, a white participant shook his litter box as instructed while he danced and whooped like a movie Indian. Harold looked at Roger as if to say, “Did you really do that?” The three Lumbee participants leveraged their experience with such behaviors by ignoring Roger’s actions completely. The Lumbee participants in Group 2 had to deal with such behavior all week long. On Monday evening after the CASP walk, Chandler belittled Dalton for his pronunciation of the word *stink*. All three Lumbee participants responded to Chandler’s actions in different ways. Larry began to talk like a movie Indian. Dalton refused to comment on Chandler’s jibe. Sherry threated to “talk White” to Chandler. Their responses dispersed tension within the group and allowed the group to continue to function. Chandler persisted with similar behaviors throughout the week, and the Lumbee participants always found a way to diffuse the situation and maintain group function.

Subtheme: Responding to misinterpretation of Lumbee English. As discussed previously, Lumbee Indians have a distinct dialect that has been documented in the literature. This dialect, known as Lumbee English, resulted from the historical isolation of the Lumbee community. During the course of the HRE, Aaron and the assistant project leader for aquatic had different understandings of the word *cooter*. Lumbee

English uses cooter to designate any aquatic turtle. The assistant project leader thought Aaron was misidentifying the turtle in question, which was a Yellowbelly Slider, as a River Cooter, a completely different species. Really, Aaron was just calling the animal an aquatic turtle. Aaron leveraged his understanding of different dialects in order to understand what the assistant project leader was telling him.

During snake dissection on Tuesday night, similar confusion occurred between Larry and me. Larry confused me by using the word *rotten* to indicate a bad smell, when I considered rotten to signify putrefaction. Larry quickly understood that there was a dialect problem, and leveraged this knowledge in a detailed explanation of what he meant by the word rotten. He finished his explanation to me in this manner, “That is what we call rotten . . . two types of rotten.”

Subtheme: Valuing strong family ties. As documented previously, the Lumbee value family ties. Aaron leveraged his ties to his family during his participation in the snake jewelry elective; he was determined to make snake jewelry for his mother. Aaron stated that he had made Two Chains the snake so that he could take it home and show it to his family. Gavin did not originally want to be at the HRE; his father made him come. However, Gavin leveraged his family ties and respect for his father in order to perform well at the HRE and to make it through the entire week.

Subtheme: Being cohesive. As noted previously, Lumbee Indians have acted cohesively against social and political discrimination by outside groups. The Lumbee participants recognized one another as members of the same community and often behaved cohesively when faced with difficult situations. Dalton, Larry and Sherry acted cohesively throughout the week in response to Chandler's repeated slights. On the last day of the HRE, Larry was clearly very upset and became unengaged in HRE activities. Dalton noticed this and tried to draw Harold back into the group. Finally, with the use of humor and teasing, Dalton and Sherry managed to improve Larry's mood. Dalton and Sherry leveraged their cohesiveness in order to reengage Larry in the group's activities.

Subtheme: Using Lumbee Meanness. As reported earlier, Lumbee meanness refers to two distinct behaviors: Lumbee sensitivity to questions about their identity as American Indians and Lumbee willingness to defend their identity as American Indians. Chandler made fun of how Dalton pronounced certain words. Taking this as a criticism of Lumbee English, Sherry said, "You want me to talk White? You don't want me to talk White." Sherry clearly leveraged meanness to make an effective defense of the dialect used by fellow Lumbees. Her statement effectively diffused tension and allowed smooth group function to continue.

Research Question 4: How Did these Lumbee Youths Contribute to the SCR CoP?

As a group, the Lumbee participants contributed to the SCR CoP in several characteristic ways. The SCR HRE was held near the periphery of the traditional Lumbee homeland, whereas the other two HREs were not. Because of this, the Lumbee participants often added to group discussions by contributing place-based knowledge about plants, animals and geography. Because of the proximity of the HRE to their homeland, these place-based stories were not just about nature, but usually applied directly to the plants and animals present at SCR, making them especially germane. At one point or another during the HRE, every Lumbee participant provided place-based input into ongoing discussions.

Only a few of the Lumbee participants contributed to the HRE as a result of knowledge learned through informal science education. The most significant examples involved information gathered at zoos or herpetological parks.

Only a few of the Lumbee participants contributed to the HRE as a result of knowledge learned through popular culture. The most significant examples involved information derived from watching television or going to the movies.

All of the Lumbee participants contributed to CoP function by being good group members. They were all collaborative and participated especially well in groups. Several of the Lumbee participants regularly used humor as a way to engage their fellow group members, and to smooth over tense moments. Their politeness and deference to others in the group facilitated smooth group function and allowed everyone a chance to contribute. Most of the Lumbee participants were self-assured: They were often quiet, but fully engaged in the group's activities. They didn't demand attention or feel the need to put themselves forward. However, when asked to perform tasks or contribute in other ways, they were almost always prepared to do so. When they did something noteworthy, they didn't require excessive praise. This quiet competence allowed their groups to function smoothly with a minimum of personality conflicts. Several, but by no means all, Lumbee participants were capable leaders who managed their groups with humor and quiet competence. All Lumbee participants were capable of being good followers when group function required it. Many of the Lumbee participants exhibited bravery when confronted with new or uncomfortable situations. This bravery allowed the groups to accomplish their goals. All Lumbee participants exhibited a strong work ethic; they performed group activities willingly in order to accomplish group goals. When some Lumbee participants were presented with tasks that they found unpleasant, they would perform them when encouraged to do so. All Lumbee participants shared stories about their families, their past experiences or their culture. These stories enhanced group discussions and engaged the groups in conversation as they moved from one task to another.

The Lumbee participants contributed to the CoP by being good community science learners. All Lumbee participants were engaged in group activities. Their curiosity and powers of observation often informed group discussions. Several of the Lumbee participants were adept at using technology and used this knowledge to contribute to their group's activities and to instruct other group members in the use of technological tools.

All of the Lumbee participants shared stories about nature that enhanced their groups' discussions of natural history. Many clearly exhibited love or empathy for animals that informed group discussions of marking or studying animals, among other things.

Some of the Lumbee participants contributed to the HRE by sharing a talent or interest. This was most obvious at the Talent Show, where several of the Lumbee either sang or danced. Other SCR CoP particpants shared their talents as well. This show was instrumental in building community throughout the entire SCR CoP. Such community building on the last night of the HRE was important because for most of the week, the participants functioned principally in their respective research groups.

Aaron’s talent for storytelling contributed to cohesiveness within the CoP because by the end of the week the entire CoP was aware of, and sometimes contributed to, the story. Taken together, these activities united the entire group and provided a group identity and cohesiveness that might not have been present otherwise.

While they were CoP members, the Lumbee participants were also members of the largest racial minority present at the HRE. The Lumbee participants recognized one another as having a common identity as American Indians. Because of this fact, the Lumbee participants were capable of responding to discrimination or stereotyping as it arose during the week. Because of the makeup of Group 2, Larry, Dalton and Sherry dealt with these situations the most. When addressing problems or issues connected with their American Indian identity, they responded with cohesiveness, humor, or mild Lumbee meanness. These responses allowed confrontational situations to diffuse and allowed group function to return to normal. The Lumbee participants were fully competent to handle these situations as they arose, and never allowed these issues to extend outside their group or beyond the immediate situation. Keeping the problems localized allowed the entire CoP to function normally without undue acrimony. A few of the Lumbee participants had to deal with misunderstandings related to their use of Lumbee English. These participants recognized these issues and immediately sought to correct misunderstandings so that group activities could continue. Several of the Lumbee participants demonstrated strong family ties, which are characteristic of the Lumbee community. These ties were used as motivation to perform certain activities, or in one case, motivation to stay at the HRE. These ties allowed these individuals to remain engaged in CoP activities and to continue their contributions throughout the entire week.

Research Question 5: How Did the SCR HRE Contribute to these Lumbee Youths' Understanding of and Engagement with Science?

As a group, the Lumbee participants agreed on several ways in which the HRE contributed to their understanding of reptiles and amphibians, and how the HRE had enhanced their engagement with herpetology and science in general.

The participants felt they had learned a lot about how to observe, capture and handle reptiles and amphibians in a manner that guaranteed safety for the animal and themselves. They placed importance on being able to distinguish between venomous and non-venomous snakes. Several participants mentioned that they had learned to be brave when handling these animals, and stressed the importance of remaining calm while handling these animals. The Lumbee participants were particularly proud of learning how to identify the various reptiles and amphibians at SCR, and of being able to add to the SCR HRE species list. To a participant, they expressed being more engaged during the HRE activities than they were with school science. Most participants felt this was due to the hands-on, outdoor nature of learning at the HRE, and that the learning involved animals.

One important aspect of how the HRE contributed to the Lumbee participants' understanding of and engagement with science was through their interactions with other participants. The Lumbee participants learned from other participants and readily acknowledged those participants from whom they had learned the most, regardless of ethnicity. Participants were asked the following interview question: “If I were to ask you to name the three smartest kids in the HRE this summer, whom would you name? “I summarize their various answers here.

Every Lumbee participant named three smartest HRE participants, but none named themselves. However, one of the Lumbee males named two of his friends and a third member of his group as the three smartest HRE students. He was the only Lumbee to name this unique set of participants.

Nine Lumbee students named 14 different student experts or smartest participants (there were a total of 27 participants at the HRE). With the exception of the one Lumbee male who named his three friends (two of whom were Lumbee), no other Lumbee participants named Lumbees as the smartest participants. Of these 14 named experts, three females were named. Two students named one female and the other females were named just once.

Two White male students were named five times each by the nine Lumbee students. Both of these males had extensive prior experience with reptiles and amphibians. Neither of these two males worked with a group that had more than one Lumbee participant.

To summarize, the nine Lumbee participants recognized expertise in a large number of other students. They provided rationales to support their choices and their two top choices were two White males who clearly had many previous opportunities to hone their herpetological expertise, including being a junior curator at the NC Museum of

Natural Sciences and being a herpetology teacher/presenter to younger children in his local school district.

In this chapter, I have presented and discussed my qualitative results. In Chapter VI, I will present and discuss my quantitative results. In Chapter VII, I present my meta-inferences for my qualitative and quantitative data and suggestions for further research.

CHAPTER VI

RESULTS AND DISCUSSION: QUANTITATIVE DATA

Introduction

Based on my review of the literature and my theoretical constructs, I developed the following research questions concerning these Lumbee youths at the SCR CoP:

1. What FoK did these Lumbee youths bring to the SCR CoP? *(FoK)*
2. How did these Lumbee youths come to have these FoK? *(Source)*
3. How did these Lumbee youths leverage their FoK? (*Leverage*)
4. How did these Lumbee youths contribute to the SCR CoP? *(Contributions)*
5. How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? *(Benefits)*

I utilized a mixed methods design involving both qualitative and quantitative data to answer my research questions. In this chapter, I report and discuss my quantitative results and conclusions. I begin the quantitative results section with a description of the instruments used to collect quantitative data. I then present the information I analyzed quantitatively in the following order: participants' demographic information and understanding of herpetology and field science at the start of the HRE, a group profile of Lumbee participants extracted from pre-survey data, an analysis of Lumbee participants' increments in understanding of herpetology and field science during the HRE, a comparison of Lumbee participants' views of science before and after the HRE, and comparison of Lumbee attendees' participation in science before and after the HRE. I complete this chapter of the dissertation with conclusions drawn from my quantitative data.

Description of Instruments Used to Collect Quantitative Data

I collected quantitative data using three instruments:

1. A test (see Appendix A) of knowledge of, and skills specific to, herpetology and field science that was administered at the beginning of each HRE and again, near the end of the HRE,
2. A Pre-survey of Science Attitudes, Interests, and Experiences (see Appendix B), and
3. A (revised) Post-survey of Science Attitudes, Interests, and Experiences (see Appendix C).

The surveys were administered immediately following the completion of the tests. The test was administered as a pretest on Sunday, and again as a post-test on Thursday. The pretest and pre-survey were administered on Sunday, and the post-test and post-survey were administered on Thursday. In the following text, I will describe the tests first and then the surveys in the order of their administration. I will present the results I gleaned from these instruments and their analyses in an order that best supports my research findings; I do not necessarily follow the temporal sequence of their administration during the HRE.

Description of Pre- and Post-tests

The pre- and post-tests were identical and thus, results could be compared in a straightforward manner. I analyzed pretest results to ascertain possible differences in herpetological or field science understanding between socioeconomic and ethnic/racial groups. I examined the post-test in order to document increments in scientific and field science understanding demonstrated by the Lumbee participants.

This test was comprised of a total of 46 questions in various sections and formats (see Appendix A): The first section was ten matching questions about the biology and habitats of reptiles and amphibians. The second section was twenty-five short answer or labeling questions concerning reptile and amphibian identification, biology, behavior, anatomy and ecology. The third section was comprised of eight practical questions that either required participants to use tools at hand to measure the length and mass of a turtle shell, or required participants to match pictures of field measurement activities with the descriptions of these activities. The last three questions asked the participants to answer questions concerning the interpretation of a graph.

Description of the Pre-survey

The pre-survey was composed of the following parts: (a) An initial section that asked participants to self-report their race/ethnicity and their domicile location (urban, suburban, or rural); (b) Their previous science experiences; (c) Their views about science; (d) Their views about school and school science; and (e) Their reasons for attending the HRE.

Description of the Post-survey

The post-survey asked the participants to reflect on their HRE experiences in five different ways:

1. They were asked if the HRE increased certain attributes connected to science, herpetology or nature (e.g., increased knowledge of science, increased interest in nature, greater confidence in doing science, and greater interest in participating in other science experiences).
2. Participants were also asked to reflect on how the HRE made them feel about certain dispositions (e.g., confident to try new things, that they could be good at science, and that they were brave).
3. The post-survey contained items that asked participants to reflect about what participating in the HRE made it possible for them to do (e.g., think like a scientist, talk like a scientist, and study science in school).
4. Sections 4 and 5 asked the participants for their level of agreement with certain statements concerning their engagement in the HRE or their feelings about science (e.g., I enjoyed learning science, it was important for me to try my hardest, and I felt ignored). Since the pre- and post-surveys were not identical, I will discuss first the findings from the pre-survey and then the findings from the post-survey.
5. Finally, I will compare select comparable items on both surveys.

Comparison of Pre- and Post-survey Structure

It is important to understand that my investigations were part of a long-term educational studies of The HERP Project. Educational researchers administered similar versions of these surveys at each HRE that occurred during 2012. While similar, the instruments varied slightly with each HRE due to the particular educational research questions being asked. As an example, items were added to the SCR HRE that were designed to gather information about the participants' domicile location and FoK.

I was interested in using parts of the pre- and post-surveys to document changes in knowledge, attitudes or behaviors as a result of attending the HRE. I was only partially able to do this for several important reasons. First, the structure of the instruments was not analogous. Although The HERP Project educational researchers designed both surveys to elicit information about science attitudes and interests, and participation in science, the two surveys have different structures and patterns of response options. The pre-survey was designed to give a portrait of each participant as they entered the HRE (described above). The post-survey was designed to provide a portrait of how participants' attitudes and feelings about science had changed during the HRE, and asked participants to speculate on whether and how those changes might affect their lives and choices in the future (described above). Further, sections were different in terms of their headings and the questions asked, and the request response patterns differed between the two instruments (this will be clear when considering results tables below). Because the information these pre- and post-survey questions were designed to elicit was similar, but the questions on the two surveys were not identical, my comparisons of pre- and post-survey items are qualitative. I was only able to compare selected items. For these reasons, my ability to show change through the HRE was inexact. While I am using parts of these surveys in a manner for which they were not intended, I maintain that I have made valuable comparisons and/or insights.

A description of the parts of both surveys helps to explain my choice of items from each survey. An understanding of the differences between the pre- and post-survey helps explain which items I chose to include from each survey to demonstrate change in the Lumbee participants' views about science and their levels of participation in science. Finally, demonstrating the differences in the pre- and post-survey justified my qualitative insights, rather than statistical substantiation of any changes revealed by these surveys.

Analysis of Quantitative Data

Participants' Demographic Information and Understanding of Herpetology and Field Science at the Start of the HRE

Demographic information. I obtained information about participants' demographic data from two sources: participant applications (see Tables 4, 5, and 6) and pre-surveys. Because I contended that rural FoK were important to Lumbee participation at the HRE, I looked at rural versus urban plus suburban domicile location for Lumbees and for all other participants (see Table 9). A Fisher's Exact Test (Howell, 2010) for two by two contingency tables revealed that Lumbee participants were significantly more rural than their non-Lumbee HRE peers.

Table 9

Domicile Locations of the Lumbee Participants vs. Non-Lumbee Participants

	Domicile Location[a]	
Ethnicity Grouping	Rural	Urban + Suburban
Lumbee	7	2
Not Lumbee	5	13

[a] A Fisher's exact test for this table indicates that these two distributions are significantly different from one-another (*alpha* = 0.014).

Understanding of herpetology and field science. I wanted to know if any demographic participant groups entered the HRE with significantly different knowledge of science and/or herpetology than other groups. I analyzed quantitative data for pretest scores by one-way ANOVA (Howell, 2010) comparing the participants' mean pretest scores for the following demographic groupings (see Table 10): sex, expert status, ethnicity, domicile location, income level, and rising grade level. I present means only for those comparisons that exhibited significant differences between groups (see Table 10).

There were a total of 27 participants; one arrived at the HRE late and could not take the pretest, and two others were hearing impaired and required extensive interpretation in order to take the pretest. The scores of hearing-impaired participants were eliminated from the analysis. Thus, my pretest results are only applicable to hearing participants who were present at the time of the test $(N = 24)$.

Table 10

ANOVA Comparison of Pretest Criteria and Criterion Groupings, Means and Standard Errors for Those Criteria That Showed Statistically Significant[a] Differences among Groups

Criterion	Criterion Groupings	Statistical Significance	Mean Correct Answers ± Standard Error by Grouping
Sex	Male, Female	HS	Males: 18.21 ± 1.31 Females: 12.35 ± 1.55
Sex – Male Experts[b]	Male, Female	NS	
Expert Status	Expert, Novice	S	Experts: 20.20 ± 1.55 Novice: 14.61 ± 1.17
Ethnicity	White, African American, American Indian, Asian/Pacific Islander, Hispanic	NS	
Domicile Location	Urban, Suburban, Rural	S	Urban[c]: 17.90 ± 3.02 Suburban: 11.50 ± 2.00 Rural: 17.38 ± 1.23
Income Level	Low, Medium, High	NS	
Rising Grade Level	Eighth, Ninth, Tenth, Twelfth	NS	

[a] NS – no statistical differences among groups; S – Statistically significant differences among groups, 0.05 > alpha ≥ 0.01; HS – Statistically significant differences among groups, 0.01 > alpha

[b] All five participants designated as experts were male and probably caused the significant differences between sexes. A separate analysis of males vs. females was performed with the male experts excluded and I found no differences between the sexes.

[c] A Tukey's multiple comparison test (Howell, 2010) of the three means showed that suburban participants had significantly lower scores than urban and rural participants. Urban and rural groups showed no significant difference in their scores.

The grand mean pretest score for the 24 participants analyzed was 15.77 (34%) correct answers out of a possible 46 correct answers. Females scored significantly lower than males on the pretest. I speculated that this difference in sexes might be due to the fact that participants who were identified as experts in herpetology or field science by HRE staff before the HRE were all males. To test this, I removed expert males from my analysis and then tested again for differences by sex (see Table 10). There was no difference by sex in this case. To further confirm this finding, I analyzed pretest scores by expert status. Experts performed significantly better on the pretest (see Table 10). I conclude that there were no real differences in pretest scores by sex among non-experts, and that the initial finding of significance by sex was due to the fact that all experts were males.

Interestingly, suburban participants scored significantly lower than both their urban and rural counterparts. I suggest that urban participants had greater access to a larger range of educational media, while rural participants may have gained their knowledge through practical experience. It is possible the suburban participants may have had less access to either of these sources of information.

A Group Profile of Lumbee Participants Extracted from Pre-survey Data

In the following text, I present data about the Lumbee participants' everyday science and family activities in order to show some of their lived experiences. An individual's lived experiences may serve as sources of FoK (Hogg, 2011, Table 3). Additionally, I present data about everyday family activities that might prepare Lumbee participants for the HRE (Ash et al., 2015; Lloyd, 2010).

Engagement in everyday science and/or family activity by Lumbee participants. A section of the pre-survey elicited information about the HRE participants' engagement in ISE. Contexts for ISE

> include a broad array of settings, such as family discussions at home, visits to museums, nature centers, or other designed settings, and everyday activities like gardening, as well as recreational activities like hiking and fishing, and participation in clubs. (Bell et al., 2009, p. 1)

I chose certain items for analyses that I felt were relevant to my research questions, as I explain in more detail below. Participants were asked about their engagement in ISE: activities that they had participated in for fun or other reasons. I categorized my chosen items in two ways that are explored in Tables 11 and 12 and the accompanying text below. Table 11 lists those pre-survey items that I categorized as engagement in everyday science and/or family activities explicitly tied to science, or visits to a designed ISE venue such as a zoo or science museum. I chose to merge the response categories Y (Yes, I did this before I participated in The HERP Project) and U (I used to do this when I was younger) in a joint category that indicated a positive response.

I calculated percentages across rows (Items) as an approximate metric of the Lumbee participants' engagement in these types of everyday science activities prior to attending the HRE. The largest percentage of Lumbee participants (88%) had visited science venues specifically designed to present science concepts (zoos, aquaria, planetariums, or science museums). A large percentage (76%) of the Lumbee youths had used special science equipment before they attended the HRE, and another large percentage (67%) of these HRE participants read science related books prior to attending the HRE. Only 44% of the Lumbee youths reported performing non-school related science research in either the library or on the Internet. Perhaps their rural locale limited their access to libraries and/or the Internet. A low percentage (33%) of the Lumbee participants reported previous science conversations with their friends or family. Both Gavin and Jewel reported these conversations, and interestingly, they were two of the four Lumbee students to have the most positive views of science (see discussion of Table 15 below). I concluded that if the Lumbee participants had access to everyday science activities, they engaged in them.

Table 11

Lumbee Participants' Engagement in Everyday Science and/or Family Activities Explicitly Tied to Science

	Participant										
Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Y + %U	% N
Visited a zoo, aquarium, science museum or planetarium	Y	Y	Y	Y	N	Y	Y	Y	U	88	22
Used special science equipment (telescope, microscope, chemistry kit, magnifying lens, etc.)	Y	Y	Y	N	U	Y	Y	Y	N	78	22
Read books about science or science fiction	Y	Y	U	N	U	Y	U	N	N	67	33

Table 11

(Cont.)

Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Y +U	% N
	Participant										
Looked up science information in the library or on the Internet that was not required for school	U	N	N	Y	U	Y	N	N	N	44	56
Talked with friends or family about science	N	N	N	Y	N	Y	Y	N	N	33	67
% Y + U	80	60	60	60	60	100	80	40	20		
% N	20	40	40	40	40	0	20	60	80		

[a] Y=Yes, I did this before I participated in The HERP Project, U=I used to do this when I was younger, but I don't do it anymore. N=I've never done this.

I calculated column percentages in Table 11 to suggest how many of these everyday science-related activities each Lumbee participant had engaged in before the HRE. The percentages of Y+U total responses ranged from 20% to 100% with a median of 60%. Seven of the nine participants were at or above the median. These data indicate that the majority of the Lumbee participants had engaged in everyday and/or family science activities.

Everyday or family activities that might prepare Lumbee participants for engagement in the HRE. The items listed in Table 12 came from the same section of the pre-survey as the items that I listed in Table 11; however, the former items were not linked explicitly to science. The types of everyday and/or family activities listed in Table

12 represent both spontaneous and more focused and deliberate science-learning activities (Bell et al., 2009).

Table 12

Lumbee Participants' Engagement in Everyday and/or Family Activities That Might Prepare Participants for an HRE Experience

	Participant										
Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Y + %U	% N
Took care of or trained an animal	Y	Y	Y	Y	Y	U	Y	Y	N	89	11
Hunted or fished	Y	Y	Y	Y	Y	Y	Y	Y	U	100	0
Spent time outside in nature	Y	Y	Y	Y	Y	Y	Y	Y	U	100	0
Visited lakes, ponds or streams	Y	Y	Y	N	N	Y	Y	Y	U	78	22
Waded or swam in a lake, pond, river, or stream	Y	Y	Y	N	Y	Y	Y	Y	N	78	22
Went camping	Y	Y	Y	Y	U	Y	Y	N	U	89	11
Worked outdoors	Y	Y	Y	Y	U	U	Y	Y	U	100	0
Attended outdoor gatherings	Y	Y	Y	Y	N	Y	Y	Y	N	78	22
Held a reptile or amphibian	Y	Y	Y	Y	N	Y	Y	Y	N	78	22
Walked or hiked in the dark	Y	Y	Y	N	N	N	Y	N	U	55	44

Table 12

(Cont.)

Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Y + %U	% N
	Participant										
Watched weather or storms	Y	N	Y	Y	N	Y	Y	Y	U	78	22
Grew vegetables or plants	Y	N	Y	Y	N	Y	Y	Y	U	78	22
Raised a farm animal	Y	N	Y	N	U	U	Y	N	N	55	44
Collected wild berries, fruits, nuts or leaves for food	Y	Y	N	N	N	Y	N	Y	N	44	56
% Y + % U	100	79	93	64	50	92	93	79	57		
% N	0	21	7	36	50	7	7	21	43		

[a] Y=Yes, I did this before I participated in The HERP Project, U=I used to do this when I was younger, but I don't do it anymore. N=I've never done this.

Spontaneous opportunities for everyday science learning may arise unexpectedly in settings and activities where there is no explicit goal for teaching/learning science. Such activities may be recreational, such as hunting or fishing, or aesthetic such as watching a sunset. Other everyday science activities may be linked to a science domain. For example, berry picking may spontaneously lead to questions about botany (Bell et al., 2009). In addition to spontaneous science learning, everyday science learning also occurs in more purposeful activities that necessitate teaching and learning. As an example, families in agricultural communities engage in science learning relative to botany and environmental conditions of certain ecosystems. Growing vegetables requires such knowledge (Bell et al., 2009). For reasons that I delineate below, I categorized these activities as everyday and/or family activities that might prepare participants for an HRE experience. As in Table 11, I chose to merge the response categories Y (Yes, I did this before I participated in The HERP Project) and U (I used to do this when I was younger) in a joint category that indicated a positive response. The percentages of Lumbee participants who engaged in these fourteen activities ranged from 44% to 100%.

I chose to include five of the items in Table 12 because of previous findings (Ash et al., 2015) about the FoK that four Lumbee male participants leveraged during an HRE as they engaged in science practices. Such activities as taking care of or training an animal, hunting, and fishing prepared these Lumbee youths to assimilate quickly into the HRE's scientific practices. Additionally, the time spent in nature as they hunted, fished, and visited and/or swam in lakes, ponds and rivers helped them to be comfortable in, and negotiate the different habitats and terrain where HRE scientific practices occurred (Ash et al., 2015). As shown in Table 12, the percentages of Lumbee participants that had engaged in these activities ranged from 78% to 100%. Although not tied to this previous research, I speculated that three other identified activities (camping, working outdoors, and attending outdoor activities) might increase the participants' comfort levels in the natural wooded areas where the HRE occurred. These pursuits also relate to activities that Lloyd (2010) identified as sources of FoK that youths from rural, upstate New York leveraged during their investigation of a local watershed. Table 12 shows that from 78% to 100% of the Lumbee participants had engaged in these three activities. In Table 12, I also included survey items that referenced HRE activities, such as holding reptiles and amphibians and taking night hikes. These activities were important to HRE scientific practices. Seventy-eight percent of the Lumbee participants had held reptiles or amphibians, but only 55% had walked in the dark. By these measures, the Lumbee participants had engaged in a large percentage (>78%) of the activities I felt would prepare them for the scientific practices of the HRE. The last four items align with activities/practices identified by Bell et al. (2009) as everyday family practices that might lead to science learning. Seventy-eight percent of the Lumbee participants had watched the weather and storms, or grown vegetables or other plants. Slightly over half of the participants had raised farm animals, and 44% had collected food in the wild.

Table 12 follows the format of Table 11, in that I calculated % Y+U by participant to assess participant activity patterns. The range of percentages of total Y+U responses by participant ranged from 57% to 100%. The median percentage was 79%. Six of the nine participants had engaged in a percentage of these activities at or above the median. The three participants below the median had percent engagements of 50%, 57%, and 64%. I concluded that even Lumbee participants with the lowest levels of engagement were at least moderately prepared for outdoor activities associated with the HRE, while most of them were very well prepared for such activities.

In Table 13, I present information about the Lumbee participants' responses to a survey item from the same section of the pre-survey as the items that I analyzed in Tables 11 and 12. This item asked participants about their science-related hobbies. Such self-directed, out-of-school activities may be life-long sources of everyday science learning (Bell et al., 2009) that help sustain interest in science (Basu & Calabrese Barton, 2007).

This item was explicitly tied to science by the phrasing and the response for this item was either yes or no. However, it was the only response in this section that asked for an explanation if a participant chose to respond yes. For this this reason, I decided to analyze this item separately.

Table 13

Lumbee Participants' Science Hobbies

Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Yes	% No
	Participant										
Do you have any hobbies that you consider to be science related?	Y[a]	Y[b]	Y[c]	Y[d]	N	Y[e]	N	N	N	56	44

[a] Building teepees and hunting.
[b] Looking at animals.
[c] Exploring the outdoors.
[d] If I saw a box turtle in the road I would take it home name it and then put it back where I got it from.
[e] Study marine animals. Read everything I can get my hands on about science.

Fifty-six percent of the Lumbee participants reported that they had science-related hobbies. Interestingly, several of the participants' hobbies linked`` to pre-survey items that I felt identified activities that would prepare participants for some of the scientific practices of the HRE (see Table 12). Aaron identified hunting as a science-related hobby, and Dalton felt exploring the outdoors was science-related. It is probable that Barry watched animals outdoors, and Gavin studied box turtles. Therefore, these four participants had engaged in activities related to their hobbies that I felt would help them participate in the scientific practices of the HRE: hunting, spending time outdoors, and handling reptiles or amphibians. Jewel identified a science-related hobby that links to the items that I listed in Table 11 as everyday science and/or family activities explicitly tied to science. She voraciously read books about science. While the other three Lumbee participants' hobbies may have prepared them for specific scientific HRE practices, I believe that Jewel's reading habits gave her a general understanding of science; such understanding also prepared her to participate in the HRE's science practices. Jewel's post-test score was 53.9 percentage points higher than her pretest score. Her increment in scores between pre- and post-test was the largest for any participant at the SCR HRE.

Lumbee Participant Increments in Understanding of Herpetology and Field Science during the HRE

I analyzed the post-test results of the Lumbee participants and compared them with their pretest scores to determine any increases in knowledge of herpetology and field science gained during the HRE experience (see Table 14). The Lumbee participants performed significantly better (one-way ANOVA, $F = 9.62$, alpha = 0.007) on the post-test (a mean of 22.6 correct answers (49 %) of a possible 46) than they did on the pretest (a mean of 14.6 correct answers, 32%), showing an average increment of 8 more correct answers, 17%. Of the nine Lumbee participants, seven demonstrated increased scores, one scored exactly the same as on the pretest, and one scored 6.5 correct answers less than he did on the pretest (see Table 14). Of the seven Lumbees who had increased scores, three had scores high enough to place them in the same range of scores as the a priori experts' scores. Possible explanations for the single lowered score will be discussed in Chapter VII. Despite the fact that two Lumbees did not make significantly higher scores on the post-test, it is quite clear that the HRE was very effective in enhancing the Lumbee participants' understanding of herpetology and field science.

Table 14

Lumbee Participants' Pre- and Post-test Scores and Increments in Test Score Achieved during the HRE

Participant	Test Metric		
	Pre-test score	Post test score	Increment
Group 1, Jewel			
Aaron	20.5	27.5	7
Barry	11.5	21.5	10
Jewel	7.0	27.5	20.5
Group 2			
Dalton	16.5	26.5	10
Larry	18.0	11.5	-6.5
Sherry	11.5	24.0	12.5
Group 3			
Gavin	9.0	17.0	8
Harold	19.0	29.5	10.5
Tonya	18.0	18.0	0.0
Mean	14.6	22.6	8.0
Standard Error	1.6	2.0	2.5

Comparison of Lumbee Participants' Views of Science before and after the HRE

I compared selected items on the pre- and post-surveys to determine any changes in Lumbee participants' views of science after attending the HRE.

Lumbee participants' views of science before the HRE. Part II of the pre-survey was designed to elicit HRE participants' views of science. Table 15 summarizes participants' responses to the pre-survey items that I chose to analyze from this section. I chose to analyze "I" or "Me" statements because I thought the use of "I" or "Me" within the item more clearly indicated a participants' view of science. The percentages of agree/strongly agree were calculated both by row (item) and by column (participant). Totaling the percentage of agree and strongly agree across rows provided an indicator of the percentage of students who agreed/strongly agreed with each of the five items. Seventy-eight percent of the Lumbee participants felt that science was important to them and that they were good at science (see Table 15).

Conceptually, science seemed to be important to over half of the Lumbee participants (67%). Despite the relatively high percentages of participants who felt science was interesting, who felt they were good at science, and who felt science was important to them; a smaller percentage of Lumbee participants agreed (33%) that they could be good scientists. An even smaller percentage (22%) agreed that they thought like scientists. To summarize, although Lumbee participants felt science was important, and that they were good at science; they did not seem to think they had the ability to think like a scientist or be a good scientist.

Totaling the percentages of agree/strongly agree responses by participant gives an estimate of the degree of science interest and/or proficiency for each individual. An individual's level of agreement or disagreement with these items becomes a rough measure of his or her view of science relative to the other participants. If I judged a participant's view using this scheme, then the higher the percentage of agree/strongly agree responses, the more positive the participant's view of science. For the nine Lumbee participants, the percentages of agree/strongly agree ranged from 0% to 100%. The median for these percentages of agreement was 60%. Seven of the participants' percentages of agree/strongly agree were at or above the median. Two of the Lumbee participants had low percentages (0%, 20%); I judged these two participants (Aaron and Barry) to have more negative views of science compared to the others.

Table 15

Lambee Participant Views of Science before the HRE

	Participant										
Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% SA + % A	% N	%D + %SD
I think science is interesting.	N	D	A	SA	A	SA	A	A	A	78	11	11
I am good at science.	N	SD	SA	A	A	SA	A	SA	A	78	11	11
Science is important to me.	D	SD	A	SA	N	SA	A	A	A	67	11	22
I think I could be a good scientist.	A	SD	D	N	A	SA	D	N	N	33	33	33
I think like a scientist.	D	SD	SD	A	A	SA	SD	D	N	22	11	67
% SA + % A	20	0	60	80	80	100	60	60	60			
% N	40	0	0	20	20	0	0	20	40			
% D + %SD	40	100	40	0	0	0	40	20	0			

Note. SD = Strongly disagree, D = Disagree somewhat, N = Neither agree nor disagree, A = Agree somewhat, SA = Strongly agree

Lumbee participants' views of science after the HRE. Table 16 presents items from the post-survey that I felt indicated Lumbee participants' views of science after attending the HRE. I assumed items that indicated participants' increased science knowledge, increased interest in science, and increased confidence in doing science represented positive views of science. I also made the same assumption about participants' feeling that they could be good at science or a related field, and views that it was possible for the Lumbee participants to think or feel like scientists. I calculated percentages of levels of agreement (see Table 16 note) with each item when collated among Lumbee participants.

Table 16

Lumbee Participants' Views of Science after the HRE

	Participant											
Item Participating in this HRE…	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% A	% S	%N
increased my knowledge of science	S	A	A	A	S	S	A	A	A	67	33	0
increased my interest in science.	A	A	S	A	A	A	S	S	A	67	33	0
increased my confidence in doing science.	S	A	S	A	S	S	S	A	A	44	56	0
made me feel I could be good at science or a related field	A	A	A	A	A	S	S	S	A	67	33	0
made me feel like it is possible for me to think like a scientist.	S	A	S	A	S	S	N	S	A	33	56	11

Table 16

(Cont.)

Item Participating in this HRE…	Participant											
	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% A	% S	%N
made me feel like it is possible for me to feel like a scientist.	S	A	S	A	S	S	S	S	A	33	67	0
% A	33	100	33	100	33	17	17	33	100			
% S	67	0	67	0	67	83	66	67	0			
% N	0	0	0	0	0	0	17	0	0			

Note. Level of agreement with each statement: N = Not at all (1), S = Slight or Moderate (2 or 3), A = A lot or a whole lot (4 or 5).

The percentages for level of agreement were the same for three of the survey items. Sixty-seven percent of the Lumbee participants agreed a lot or a whole lot and 33% expressed slight or moderate agreement that participating in the HRE increased both their knowledge of science and interest in science; and made them feel that they could be good in science or a science-related field. Forty-four percent of the Lumbee participants agreed a lot or a whole lot, and 56% agreed slightly or moderately that participating in the HRE increased their confidence in doing science. Thirty-three percent of the Lumbee participants agreed a lot or a whole lot, and 67% agreed slightly or moderately that the HRE made it possible to feel like a scientist. There were no negative responses to any of these three items. Thirty-three percent of the Lumbee participants agreed a lot or a whole lot, and 56% agreed slightly or moderately that the HRE made it possible for them to think like a scientist. One negative response (Larry) was registered for this item.

When I considered the frequency of positive and negative participant responses (columns) to the six views of science items mentioned in Table 16, each participant gave 100% affirmative responses with the exception of Larry who responded with 83% affirmative responses. Larry's single negative response was in reference to the statement that attending the HRE made him feel more capable of thinking like a scientist. From pre-survey data, I had judged Aaron and Barry to have less positive views of science (combined 10% SA + 0% A) than their Lumbee HRE peers (60 % to 100 % SA + A) (see Table 15). However, in the post-survey, Barry agreed a lot or a whole lot (100%) for all items that I analyzed to gauge Lumbee participants' views of science after the HRE. Although Aaron did not respond as positively as Barry (33% A and 67% S vs. 100% A) for post-HRE views of science items, both young men did have 100% affirmative responses. I feel that their views of science improved.

Comparison of Lumbee Participants' Involvement in Science before and after the HRE

Participation in science before the HRE. The items in the first section of the pre-survey were designed to ellicit information about some of the Lumbee participants' experiences in formal science education (FSE) and informal science education (ISE) contexts. Table 17 lists the items from this section that I chose to analyze.

FSE typically occurs in a science classroom within the confines of the school day (Bell et al., 2009). Three of the pre-survey items that I listed in Table 17 are explicitly linked to FSE by their phrasing: taking an extra school non-required science class, doing well in science classes, and having a teacher who makes science exciting.

Table 17

Lumbees' Participation in Science before the HRE

Item	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% Yes	% No
	Participant										
FSE											
Extra summer school science class (not a make-up class)?	N	N	Y	N	N	N	N	N	N	11	89
Award or special recognition for doing well in science	N	N	N	Y	N	N	N	N	N	11	89
Teacher who made science exciting to learn	Y	N	N	Y	Y	Y	N	Y	N	56	44
ISE within a School Context											
Participated in …											
Science fair?	N	N	N	Y	Y	Y	N	Y	Y	56	44
Science club/ team?	N	N	N	Y	N	Y	N	Y	Y	44	56
ISE outside of a school context											
Attended a special science program?	Y	N	Y	N	N	N	N	N	N	22	78
Worked on a science project at a university or professional lab?	N	N	N	Y	N	N	N	N	Y	22	78
% Yes (summed)	29	0	29	71	29	43	0	43	43		
% No (summed)	71	100	71	29	71	57	100	57	57		

ISE occurs after school hours or outside of school. ISE may occur in structured contexts. Some ISE may occur within a school context, but not during science class and outside of regular school hours (Bell et al., 2009). Two of the survey items that I include in Table 17 allude to ISE that occurs within a school context: the item that refers to participation in a science fair and the item that asks about participation in science clubs/teams. Also, structured ISE may occur in institutionalized contexts provided by such entities as libraries, community-based organizations, government agencies, institutions of higher learning, and philanthropic foundations (Bell et al., 2009). The last two items in Table 17 refer to this type of ISE: the item that asks about attendance in a special science program and previous work in a university or professional lab.

For Table 17, I calculated the percentages of yes and no responses both for rows (items) and columns (participants). Total percentages of yes and no responses across rows roughly indicate how many Lumbee participants felt they had participated in a particular science experience. For FSE experiences, 56% of the Lumbee participants reported that they had engaged with a science teacher who made science exciting. Only one student (Gavin) had taken an optional summer school science class, and only one student (Dalton) had received a school science award. The Lumbee youths had better participation in ISE in a school context. Fifty-six percent of these participants reported participation in a science fair, and 44% of the Lumbee youths reported participation in a science club or team. The percentages for participation in ISE in institutional contexts were low. Only 22% of the Lumbee youths had participated in a special science program or worked in a university or professional lab.

I calculated the percentages of yes and no responses by participants (columns) as rough indicators of an individual's previous science experiences (both FSE and ISE) (Table 17). The percentages of yeses for the Lumbee participants ranged from 0 to 71%. The median of these percentages is 29%. A median of 29% would seem to indicate that (at least for those experiences listed) the Lumbee participants had limited previous science experiences. Five of the Lumbee participants were at median or below, and two of these participants reported that they had had none of these experiences. While four participants had averages above the median, three of these participants' percentages of participation were only 44 %. A single student, Gavin, had a high percentage of participation (71%).

Participation in science after the HRE. Table 18 presents items from the post-survey that I felt indicated how participation in the HRE increased the Lumbees' interest in future participation or engagement in science experiences. All Lumbee participants responded positively when asked if the HRE increased their interest in participating in other science experiences: the possibility of their joining a science-related club/ group, or starting a science hobby. Calculating percentages across rows indicates the percentage of Lumbee participants who agreed with an item (see Table 18 note). All Lumbees agreed that attending the HRE increased their interest in participating in future science experiences in general. Seventy-five percent of the participants responded with agreed a lot or a whole lot, while 25% agreed slightly or moderately with the statement. Sixty-seven percent of the participants agreed a lot or a whole lot that attending the HRE made them think about starting a science hobby, while 33% agreed moderately or slightly with this item. Fifty-six percent of the participants agreed a lot or a whole lot, and 44% moderately or slightly agreed that they would think about joining a science-related club after the HRE. As no participant responded in the negative to any of the items in Table 18, I concluded that all participants felt more empowered to engage in scientific activities after the HRE.

Table 18

Indicators of Increased Participation in Science by Lumbee Participants after the HRE

	Participant											
Statement Participating in this HRE…	Aaron	Barry	Dalton	Gavin	Harold	Jewel	Larry	Sherry	Tonya	% A	% S	%N
increased my interest in participating in other science experiences.	A	A	A	S	A	A	S	–	A	75	25	0
made me feel like it is possible for me to think about joining a science-related club or group.	S	A	A	A	S	S	S	A	S	56	44	0
made me feel like it is possible for me to start a science hobby.	S	A	A	A	S	S	S	S	S	67	33	0
% A	33	100	100	67	33	33	0	33	33			
% S	67	0	0	33	67	67	100	33	67			
% N	0	0	0	0	0	0	0	0	0			

Note. Level of agreement with each statement: N = Not at all (1), S = Slight or Moderate (2 or 3), A = A lot or a whole lot (4 or 5).

Quantitative Conclusions

General

I gathered various types of data from the pre- and post-tests and the pre- and post-surveys. I used these different data types to address several of my research questions. Analysis of the quantitative data allowed me to know and understand the Lumbee participants better. These data added specific detail for each Lumbee participant's profile (see Chapter IV). My analyses also informed my understanding and knowledge of the Lumbee participants as a group. The quantitative data provided triangulation for participants' information that I gleaned from qualitative sources. My analysis of the performance on the pretest by race and ethnicity revealed that there was no significant difference among ethnic groups (see Table 10). As a group, the Lumbee participants came to the HRE with the same level of knowledge of herpetology and field science as any other ethnic group. This finding contrasts with the reported performance gaps of American Indian students who attend NC public schools (NCDPI, 2011; Orfield et al., 2004); including Lumbee Indians who attend public schools (North Carolina State Advisory Council on Indian Education [NCSACIE], 2012). These gaps position Lumbee Indian students as disadvantaged in school performance in general, and in science achievement, in particular. My statistical analysis of domicile location (rural vs. urban + suburban, see Table 9) revealed that the Lumbee participants were significantly more rural than their HRE counterparts. That the majority of Lumbee participants had rural domiciles was also substantiated by the location of the schools they attended (see Table 7). My statistical analysis of pretest scores revealed no significant differences between the scores of rural and urban participants (see Table 10), however both of these groups performed significantly better than their suburban counterparts. Therefore, rural participants (including the Lumbee participants) came to the HRE with the same level of knowledge associated with herpetology and field science as their urban counterparts. I concluded that these rural Lumbee participants were as prepared for this HRE as any other group of students.

Though pretest scoring was about the same among all ethnic groups, the overall scores were lower than one might expect (Table 10). This might be explained by the fact that a small proportion of the Essential Standards for Biology in the North Carolina Standard Course of Study (NCSCS) address ecological topics. The current NCSCS is composed of Common Core State Standards in English language arts and mathematics and the North Carolina Essential Standards in all other subjects, including Science NCDPI, n.d.a). The North Carolina Essential Science Standards divide the Life, Physical, and Earth Sciences into content strands. The content strands for the Life Sciences are: Structures and Functions of Living Organisms, Evolution and Genetics, Ecosystems, and Molecular Biology. In the high school science program, the Life Sciences content strands are taught in Biology (NCDPI, n.d.b).

I analyzed the essential science standards and clarifying objectives for high school biology, and I found that the standards' coverage of the Life Sciences skews study toward cellular and molecular topics. The number of essential standards and clarifying objectives for each content strand follows: Structures and Functions of Living Organisms (two essential standards, six clarifying objectives); Ecosystems (two essential standards, six clarifying objectives); Evolution and Genetics (five essential standards, 14 clarifying objectives); Molecular Biology (two essential standards, five clarifying objectives; NCDPI, n.d.b). Thus, there are 31 clarifying objectives. Using the wording of these 31 clarifying objectives, I placed them in the following categories: molecular, cellular, ecological, and evolutionary. It is important to note that my classification of the clarifying objectives might not place them where one might expect. For example, I classified all the clarifying objectives listed under the content strand *Molecular Biology* as *molecular*. However, I also classified five of the fourteen clarifying objectives listed under *Evolution and Genetics* as molecular. As an example, clarifying objective Bio. 3.1.2 indicates that a student should be able to "explain how DNA and RNA code for proteins and determine traits" (NCDPI, n.d.b, p. 2). Students must understand these processes in order to understand both genetics and evolution, but clearly these processes occur at a molecular level within the cell.

From my analysis, I found the following numbers for the different categories: molecular (11); cellular (8); ecological (6); and evolutionary (6). When I combined the molecular and cellular categories (19), I found that 61 % of the clarifying objectives were in these categories. I only classified 19 % of the clarifying objectives as belonging to the ecological category. These percentages seem to indicate that the North Carolina high school biology curriculum covers three times as many cellular/molecular topics as ecological topics. Further, I found no essential standards or clarifying objectives that address taxonomy or systematics. I conclude that the formal educational deficits described above make it very difficult for any participant to come to an HRE with the tools necessary to perform well initially, unless they are self-taught or have participated in ISE that has increased their knowledge of herpetology or field science. This was the case for the five male participants who were identified a priori as experts (see Table 10).

Quantitative Findings That Can Be Used to Answer My Research Questions

I discuss the implications of the quantitative results as they apply to specific research questions below. I cannot address all research questions with these data, only those for which specific connections can be made.

Research Question 1: What FoK did these Lumbee youths bring to the SCR CoP? It is apparent that the Lumbee participants brought a variety of FoK to the HRE. Clearly, everyday science activities were something that most of the Lumbee engaged in, although these activities might not necessarily be different from activities performed by their HRE peers (see Table 11). Importantly, the Lumbee participants showed a high degree of participation in a variety of activities that occurred in outdoor settings, or that required knowledge of plants or animals (see Table 12). It is possible that these activities were FoK that allowed them to perform as well as their urban peers on the pretest, and better than their suburban peers. In the same vein, Lumbee participants reported hobbies that were, by and large, of an outdoor nature and linked to pre-survey items involving the outdoors (see Table 13).

Research Question 2: How did these Lumbee youths come to have these FoK? Previous lived experiences acquired through everyday science and/or family activities are identified sources of FoK (Hogg, 2011, Table 3). I have shown that the Lumbee participants were clearly more rural than their counterparts. The activities reported in Table 12 are intimately associated with access to the natural world; such access would seem to be much easier for rural residents. I propose that such ease of access is a reasonable explanation for the acquisition of these FoK. Self-learning of science can occur through the pursuit of hobbies (Basu & Calabrese Barton, 2007). Such hobbies can be connected with the outdoors and can also be a source of FoK (Lloyd, 2010).

Research Question 5: How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? Lumbee participants performed significantly better on the post-test than on the pretest (see Table 14). Obviously, the participants' understanding of herpetology and field science improved over the course of the HRE. All Lumbee participants felt that their knowledge of science had increased during the HRE (see Table 16). Sixty-seven percent of the Lumbees agreed that participating in the HRE increased their knowledge of science significantly. Thirty-three percent of Lumbee participants agreed the HRE had somewhat increased their knowledge of science. Interestingly, the one Lumbee participant who scored lower on the posttest than on the pretest nevertheless overwhelmingly agreed that his knowledge of science had increased during the HRE (see Table 16).

Only 22% of Lumbee participants had engaged in ISE activities outside of a school context before the HRE (See Table 17). Since the HRE was an ISE activity that occurred in an institutionalized context, the level of engagement in such an activity went to 100% due to their attendance. Fifty-six percent of the Lumbees had participated in a science fair and 44% had participated in a science club or science team (ISE within a school context). However, post-survey responses indicated that 100% of the Lumbees felt that HRE participation had made it possible for them to consider joining a science club or group (see Table 18). All of the Lumbee participants felt it would now be possible to start a science hobby. The HRE also seemed to increase all participants' desire to engage in other science experiences (see Table 18). I concluded that participation in the HRE increased the Lumbees' predisposition to engage in ISE both within a school context, and also in non-school contexts.

To understand post-HRE views, I compared items from the pre-survey (Table 15) that matched closely with similar items from the post-survey (Table 16). I present these comparisons below, giving the pre-survey statement first and the post-survey statement second. Comparison 1: I think science is interesting (78% agreement); Participating in this HRE increased my interest in science (100% agreement). Comparison 2: I am good at science (78% agreement); Participating in this HRE increased my confidence in doing science (100% agreement). Comparison 3: I think I could be a good scientist (33% agreement); Participating in this HRE made me feel I could be good at science or a related field (100% agreement). Comparison 4: I think like a scientist (22% agreement); Participating in this HRE made me feel like it is possible to think like a scientist (89% agreement). Remarkably, the greatest increases in agreement scores had to do with the Lumbee participants' ability to visualize themselves as good at science, and to think like scientists. If these statements are true, then it naturally follows that these individuals will be more likely to engage in science in the future.

In Chapter V, I presented results and conclusions for my qualitative data. In this chapter, I presented results and conclusions for my quantitative data. In Chapter VII, I will present signature FoK and contributions to the HRE for each participant. I will then describe those meta-inferences that are supported by both qualitative and quantitative data. Finally, I discuss directions for future research and the limitations of my study.

CHAPTER VII

META-INFERENCES AND IMPLICATIONS FOR FUTURE RESEARCH

In Chapter VII, I present my conclusions about the most characteristic FoK of each Lumbee participant and their most significant contributions to the HRE community. After my discussion of each participant's signature FoK and contributions, I integrate data from qualitative and quantitative research strands to draw meta-inferences in order to more fully answer my five research questions:

1. What FoK did these Lumbee youths bring to the SCR CoP? *(FoK)*
2. How did these Lumbee youths come to have these FoK? *(Source)*
3. How did these Lumbee youths leverage their FoK? (*Leverage*)
4. How did these Lumbee youths contribute to the SCR CoP? *(Contributions)*
5. How did the SCR HRE contribute to these Lumbee youths' understanding of and engagement with science? *(Benefits)*

Next, I present implications of my conclusions for researchers who are interested in how diverse students leverage their FoK in order to negotiate the practices of CoPs involved with informal science education (ISE) in outdoor settings. While my work was done in an informal situation, some of my recommendations may apply to classroom contexts. I then discuss the practical implications and limitations of this study.

Characterizations of Signature FoK and Contributions to the HRE CoP for the Nine Individual Lumbee Participants

In Chapter V, I offered conclusions drawn from my qualitative data about my research questions that considered the Lumbee participants as a group. Below, I attempt to characterize each Lumbee participant according to their signature, or most characteristic, FoK and contributions to the CoP. The participant descriptions I provide represent unique answers to my research questions for each individual. I have distilled my research questions into five descriptors that are reflective of them: signature or defining FoK of each of the Lumbee Participants (*FoK*), the sources of these FoK (*Source*), how each participant leveraged his or her FoK (*Leverage*), the contribution each participant made to the SCR CoP (*Contributions*), and finally the contributions made by the HRE to each participant's understanding of and engagement with science (*Benefits*). While I will not repeat these descriptors for each participant, they will be discussed in the order they are defined above.

Aaron

A talented storyteller, Aaron built community by incorporating other group and community members into his humorous stories. A sense of community is an important aspect to many Lumbee (Blu, 2001; Dial, 1993; Sider, 2003); Aaron learned storytelling from his family. In another community building endeavor, Aaron developed a game he called *Ultimate Ultimate Dodge Ball* that the male HRE participants played in their cabin. Aaron's stories helped bond the diverse members of the CoP, and his dodge ball game helped the male participants bond. Aaron learned not only how to handle reptiles and amphibians, but he felt he learned enough herpetology to begin to tell reptile and amphibian stories to his friends. Prior to the HRE, Aaron reported that he did not talk to his friends or family about science. However, during the course of the HRE, he began to talk with his new friend Thomas (an a priori expert participant) about science. Although Aaron reported that he did not often engage in school science activities, he engaged in all HRE activities.

Barry

Barry was a good group follower, and he brought empathy and love of animals to the HRE. His FoK were derived from his disposition. Barry was determined to learn more about animals, but he was shy and retiring. To help overcome his shyness, Barry developed a close relationship with a camp counselor who helped facilitate Barry's engagement in the HRE activities. As the week progressed, Barry engaged in HRE activities to the best of his ability. With the camp counselor's help, Barry's engagement became more independent during the course of the HRE; and he helped his group with their scientific practices. Barry felt he was engaged in all HRE activities, and his engagement increased his interest in reptiles and amphibians. He was happy that he learned to identify different species of lizards, turtles and frogs. Towards the end of the week he described himself as a "science learning person."

Dalton

Dalton was a leader with a strong work ethic. Dalton's leadership abilities and work ethic were part of his disposition. Chavis (2011) documented that a strong work ethic was emphasized at the school Dalton attended. Dalton led his group the entire week, and he also led any elective or other group in which he participated. He used his leadership skills and work ethic to assign duties to other group members to ensure that tasks were accomplished in an efficient and timely manner. Dalton felt he actively engaged in HRE activities, but at school he was more of an observer. Dalton felt he learned new things during every activity; he learned how to identify different species, how to sex reptiles and amphibians, and how to identify venomous and non-venomous snakes. He felt more engaged in science during the HRE because he helped find new species (previously undocumented by the HRE) at SCR and helped other participants to recognize species of reptiles and amphibians.

Gavin

Gavin was self-assured and helpful. Both attributes were aspects of his disposition. Being self-assured may be an attribute of a reflective learning style, which may be present in some American Indian communities. Reflective learners tend to stop and think before responding to questions (Pewewardy, 2002). Gavin did not demand attention or praise. Whenever he felt help was needed, Gavin readily provided it, and he consistently performed necessary tasks before being asked. Because of these attributes, Gavin never disrupted group activities, but rather contributed to group efficiency. He was never a distraction to other group members. Thus, Gavin's helpfulness and self-assuredness contributed to his group's efficiency. Gavin usually thought before he spoke, so his comments were usually insightful. Gavin was very engaged in the HRE activities. Although Gavin reported in the pre-survey that his hobby was studying box turtles, he said that the HRE had taught him that he knew a lot more about reptiles than he thought he knew. Gavin felt that the HRE had not only increased his engagement in science but had increased his desire to be "social" and "interactive" when he returned to school.

Harold

Harold's contributions to the HRE were largely due to his sense of humor and his place-based knowledge, gained from growing up and living on a farm. Harold used his sense of humor to ease tensions during uncomfortable situations, to stay engaged and to tease group members to promote camaraderie. He kept his group upbeat with his humor when work became tedious. He leveraged his place-based knowledge to enhance discussions about natural history by relating knowledge about his family. Harold felt he had contributed to the HRE by identifying new species at SCR. He learned a lot about snakes - how to find and capture them, and how to identify venomous and non-venomous snakes. Harold was engaged because of the hands-on nature of the activities. Harold demonstrated a clear understanding of mark recapture techniques. He felt that one of the most important skills he had learned at the HRE was to be brave, as he felt a good scientist needed to be brave.

Jewel

Jewel was brave and self-assured. She exhibited place-based knowledge that she brought from her home. Her bravery was part of her disposition. Being self-assured was also part of her disposition, but may have been an aspect of her American Indian learning style (Pewewardy, 2002). She leveraged her bravery by catching animals and emptying traps even though she was afraid. She felt her self-assured demeanor allowed her to do this work without "squealing like a girl." Jewel used her place-based knowledge about sassafras tea to enhance a group discussion of natural history. She contributed to group discussions by providing place-based knowledge. She was a self-assured group member who quietly engaged in group activities. She said she learned awareness of animals and what could happen if she touched an animal, and she learned to inspect animals for injury or illness. She felt she was more engaged than at school because there were more hands-on activities. She was very excited to have learned about Two-Toed Amphiumas.

Larry

Larry was a leader with a sense of humor. He had place-based knowledge due to fishing and hunting. Being a leader and having a sense of humor was part of Larry's disposition. His place-based knowledge came from his hunting and fishing activities with his family at his home and on trips. Larry used his leadership abilities and sense of humor to guide his group throughout the entire week. He used his place-based knowledge to identify tracks and signs of animals during group activities, as well as to enhance group discussions of natural history. He was a particularly good night leader due to his place-based practices of engaging in outdoor night activities. He minimized instances of possible stereotyping of American Indians by a group member by responding with humor, which eased tensions. His actions kept this issue within his group so that it did not escalate to the entire CoP. Larry was very engaged at the HRE, which he described as, "fun, exciting and awesome." He learned how to identify new species of reptiles and amphibians. Larry felt that the knowledge he had gained would allow him to be ahead of others in his science class when he returned to school. He learned that scientists must record their field data quickly and accurately, and he felt that he had acquired important field skills including being a good lizard lassoer.

Sherry

Sherry had a sense of humor and was brave and collaborative. Her sense of humor and bravery were part of her disposition, but her bravery grew during the HRE. Sherry employed her bravery to handle reptiles. Her ability to collaborate was also part of her disposition, but it may also have been an aspect of her American Indian learning style. Some American Indian youth have been characterized as being collaborative learners who enjoy working in cooperative groups (Castango & Brayboy, 2008; Pewewardy, 2002).

Sherry took the lead within her group when it was necessary to deflect perceived discriminatory remarks or stereotyping of Lumbee participants. She used her sense of humor and her collaborative abilities to unite the three Lumbee participants within her group. Although she had differences with Chandler, she repeatedly collaborated with him. Sherry was key to allowing Group 2 to function successfully despite Chandler's repeated needling. During the last day of the HRE, her fellow Lumbee group member, Larry, was clearly so upset that he disengaged from all group activities. While it is not clear why he did this, it may have been a result of Chandler's actions. Sherry worked hard all week to keep this situation under control and contained within her group. When she and Dalton noticed that Larry was disengaged on Friday, they immediately attempted to reengage Larry in the group's activities, using humor to tease Larry into a better mood.

Sherry learned how to identify different species of amphibians and reptiles and the importance of releasing animals where they were captured. She also learned that she should be cautious when handling snakes if she did not know if they were venomous or non-venomous. She learned how to handle non-venomous snakes calmly. She was proud that she helped add two species to the SCR reptile and amphibian species list. She felt engaged by the hands-on activities during the HRE.

Tonya

Tonya was helpful and self–assured as a result of her disposition. Her self-assured nature may result, in part, from her American Indian learning style (Pewewardy, 2002). Tonya facilitated the successful functioning of her group because if she saw something that needed to be done, she helped do it. Tonya chose to be quiet during group activities, and she did not require attention. Her helpfulness and self-assurance allowed her to contribute quietly but efficiently to her group. Tonya did not need to put herself forward, but was cooperative in the completion of group tasks. One of her goals was to hold a snake, which she did during the HRE. She felt she had learned a lot about catching and handling reptiles and amphibians. As she was fond of turtles, she was happy that she learned to identify different species of turtles. Tonya learned the value of stealth when looking for animals at night. She felt more actively engaged at the HRE when compared to school science because there were more hands-on activities at the HRE.

Meta-inferences

In this section, I integrate my qualitative and quantitative results to produce more robust conclusions to answer my five research questions (*FoK*, *Source*, *Leverage*, *Contributions*, and *Benefits*). These meta-inferences (Tashakkori & Teddlie, 2003) elucidate the most salient findings of this study.

My data analyses provided ample evidence that the Lumbee participants brought and leveraged a variety of FoK to the HRE. This variety of FoK is evident in the themes that emerged from my analysis of the qualitative data (see Table 8) and in my qualitative discussion of the signature FoK of individual Lumbee participants. Lumbee participants' FoK made them good group members and good community science learners. The Lumbee participants leveraged their FoK in several important ways: group leadership, collaborative learning styles, knowledge of natural ecosystems, and willingness to bravely attempt activities that were new to them. The nature of the FoK brought to the HRE is evident from my quantitative data. Everyday science activities (*Source*) were something that most (median, 60%) of the Lumbee engaged in before the HRE (see Table 11). Importantly, the Lumbee participants showed a high degree (median, 79%) of participation in a variety of activities that occurred in outdoor settings, or that required knowledge of plants or animals *(Source)* (see Table12). In the same vein, Lumbee participants reported hobbies that were, by and large, of an outdoor nature and linked to pre-survey items involving the outdoors *(Source)* (see Table 13, 56% of the Lumbee participants reported that they had science-related hobbies.). What is evident in the qualitative data that is not evident in the quantitative data is the importance of ways of being (*FoK*). The dispositions (*FoK*) of the Lumbee participants determined how they leveraged their FoK during the HRE.

My qualitative data showed that a rural lifestyle gave the Lumbee participants unique FoK. Repeatedly, Lumbee participants drew on place-based knowledge of agricultural practices, hunting and fishing, and living in rural environments in close proximity to wooded areas and large drainage canals *(Source)* to enhance group discussions *(Contributions)* or to further their understanding of what they were being taught at the HRE (*Benefits*). My quantitative data support the finding that the Lumbee participants were clearly more rural than their counterparts. The activities reported in Table 12 *(Source)* are intimately associated with access to the natural world; such access would seem to be easier for rural residents. The quantitative data emphasized the importance of a rural lifestyle *(Source)* to the Lumbee participants' self-image and to the FoK that they brought to the HRE.

Both my qualitative and quantitative data clearly showed that the Lumbee participants increased their scientific knowledge at the HRE *(Benefits)*. During their interviews, the Lumbee participants repeatedly stated how much they had learned during the HRE. The participants were very specific about what they felt they had learned in most cases. A majority thought that they had learned a lot about: the identification of reptiles and amphibians, how to capture, mark and humanely handle reptiles and amphibians, how to be cautious when handling live animals, and how to recognize venomous snakes *(Benefits)*. My quantitative data support the qualitative findings that the Lumbee participants increased their knowledge of herpetology *(Benefits)*. Lumbee participants performed significantly better on the post-test than on the pretest *(Benefits)* (see Table 14, one-way ANOVA, F = 9.62, alpha = 0.007). Further, when responding to the post-survey, all Lumbee participants felt that their knowledge of science had increased during the HRE *(Benefits)* (see Table 16). Participants indicated that they learned more efficiently due to the hands-on, practical nature of the SCR CoP practices and activities that they engaged in. For instance, the particpants learned how to identify and capture animals by doing exactly that in the field. Such practices were part of the SCR CoP's shared repertoire.

Qualitative data offer a possible explanation for why Larry scored lower on the post-test than on the pretest; the quantitative data do not provide such an explanation. The qualitative data suggest that he had become progressively angry about possible discrimination and stereotyping by a fellow group member. By the day of the post-test, Larry had been experiencing this problem for at least four days and was obviously upset. However, despite his low test score, qualitative data reveal that he was a significant contributor to his group for most of the week *(Contributions)* and that he felt like he had learned a lot at the HRE (*Benefits*). Further, he said that the HRE had prepared him to do better in his science classes at school the following fall (*Benefits*).

The qualitative data showed that almost all Lumbee participants reported feeling more engaged in science (*Benefits*) during the HRE than during school science activities. Perhaps their levels of engagement at the HRE inspired their hopes of increasing their engagement in future ISE activities. Quantitative data supported this idea because participation in the HRE seemed to result in an increase in all Lumbee participants' predispositions to engage in ISE both within a school context, and also in non-school contexts (*Benefits*) (see Table 16). What is clearly evident from the qualitative data is that the Lumbee participants felt more engaged by science activities because (as they repeatedly stated) these activities were more hands-on than many of their previous school science activities (*Benefits*). The hands-on science activities from the Lumbee participants' perspectives included such things as helping to retrieve traps, collecting data on animals they held in their hands, and filing the identifying marks on turtles.

The qualitative data also clearly indicate that the Lumbee participants were more engaged in activities when they were able to handle animals (*Benefits*). Qualitative data showed that most Lumbee participants were more comfortable in field science situations and more comfortable handling reptiles and amphibians after the HRE (*Benefits*). Some Lumbees felt that they could be better scientists when they went back to school because of the HRE experience. Quantitative data corroborated these statements. Data derived from comparisons of Tables 15 and 16 clearly indicated that Lumbee participant views of their scientific abilities and their interest in science had increased over the course of the HRE (*Benefits*). The qualitative data provided stories that revealed specific examples of how Lumbee participants overcame their fear of specific reptiles or amphibians (*Benefits*). The qualitative data also disclosed instances of Lumbee participants reporting specific occurrences of how they behaved as scientists or felt that they contributed to the HRE CoP's scientific knowledge (*Benefits*) by adding to the SCR HRE species list and contributing to the aquatic turtle and lizard mark-recapture studies.

Directions for Future Research

This study examined the FoK of nine rural Lumbee youths that were leveraged to gain LPP in an HRE situated within their homeland. As evidenced in Table 11, these Lumbee youths brought many lived experiences with them to the HRE that provided them knowledge and skills that helped them be successful members of the HRE community. Because the HRE setting and some practices was so similar to the environmental settings and everday outdoor practices of their homeland, integration of Lumbee participants into the HRE may have been comparatively easy. Familiarity with and ease in outdoor settings provided a level of support perhaps not experienced by many HRE participants. FoK are formed in different contexts and the specific FoK that youth have may not be leveraged successfully in all contexts (Hogg, 2011; Lloyd, 2010).

Future research might explore what FoK rural Lumbee youth from the same community would employ in other informal educational contexts. Indoor science settings such as summer participation in university laboratories (Hay & Barab, 2001), zoos, and nature museums would be informal in nature, but would invoke different FoK than the outdoor setting studied here. Informal outdoor settings that occurred in different geological or ecological settings unfamiliar to the participants might require Lumbee youth to leverage different ways of knowing and being than those required in a familiar landscape.

Unlike the rural subjects of my study, some Lumbee youth reside in urban areas such as Raleigh and Greensboro, North Carolina, and also in Philadelphia, Detroit and Baltimore (Dial, 1993; Evans, 1979). Across the nation, more than half of the American

Indian and Alaska Native populations now live away from their traditional homelands. Similar to the Lumbee who have migrated away from rural areas, these groups sought better education or employment in more urban regions (U.S. Department of the Interior: Indian Affairs, 2015). The FoK leveraged by urban youth would likely be different than those deployed by rural youth. Future research might reveal what FoK these urban youth would leverage to gain membership within CoPs similar to the one discussed here.

Clearly, the majority of these Lumbee participants came from a rural background and applied FoK from these backgrounds to their advantage at an HRE that was located in a rural setting. It would be interesting to see how rural Lumbee students leveraged their rural FoK at school. Such an approach would be complimentary to research that documents how students leverage FoK in inner city schools (Basu & Calabrese Barton, 2007; Calabrese Barton & Tan, 2009; Calabrese Barton et al., 2008; Moje et al., 2004).

Many American Indian students are quiet in class and reflective (often resulting in what seems to be hesitation) in their responses to instructional questions; and this may also be the case for some Lumbee students (Castagno & Brayboy, 2008; Harrington, 2012; Pewewardy, 2002). The voices of quiet students may not be heard or documented in standard methods of collecting qualitative data (videos, audio files, and interview transcripts). Research should be conducted concerning methodology for documenting the voices of these quiet American Indian learners.

Finally, research concerning the FoK that other minorities bring to informal learning settings would expand the knowledge base established here for Lumbee American Indians.

Limitations of the Study

Research Design Limitations

While this study provided insights into how the FoK of rural Lumbee youth can affect the CoP in an informal herpetological field setting, it may have limited use in furthering our understanding of CoPs in broader or more formal settings.

This study was restricted in scope to the week-long SCR HRE held July 10-15, 2012, and to nine Lumbee Indian youths (six males and three females) who attended this HRE. My results were focused on these nine individuals only. Therefore, two limitations of my study were the short duration of the HRE and the limited number of participants. The Lumbee participants were mostly rising ninth graders (seven participants), with one rising tenth grader, and one rising eleventh grader. Thus, the age distribution of my research population was another limitation.

Some field activities may present Native American students with cultural conflicts and such potential impacts must be considered in advance (Vierling, Bolman, & Lane, 2005; Zwick & Miller, 1996). I failed to assess such conflicts in this study, but I recommend that in future studies, researchers consult with community members beforehand (Castagno & Brayboy, 2008). In summary, experiences such as the HRE show great promise for enhancing American Indians' education, but the specifics of each case must be considered beforehand.

Avoidance of Essentialization of Lumbee American Indians

Field experiences such as those in the HRE have the potential to influence learning by American Indians in other settings (Ash et al., 2015). However, such extensions must be considered with caution. American Indians are often considered disadvantaged in traditional learning environments (Castango & Brayboy, 2008). I feel that my study highlights the strengths (FoK) of these Lumbee youths in a informal outdoor learning experience. It is my hope that similar experiences would showcase the FoK of other American Indian youth. Generalization of findings such as this can be problematic (Hogg, 2011). Hogg (2011) argued that numerous studies in different fields (such as literacy, cultural geography and youth cultures) support evidence of a variety of FoK that form in different contexts (Thomson & Hall, as cited in Hogg, 2011). In addition, a youth's FoK evolves as the youth's life and family's lives change (Andrews & Yee, as cited in Hogg, 2011). Therefore, Hogg (2011) warned against generalizing findings from FoK research because of the personalized quality of FoK. Additionally, Brayboy and Castagno (2008) remind us that there is no single American Indian culture; there are over 500 different tribal nations found in the U.S. These nations have unique histories, languages, and cultures. Acknowledging that similarities may exist between culturally different tribes, they caution against the assumption of a unified "Native science" or "Native epistemology" (Brayboy & Castagno, 2008). Therefore, I cannot assume that all Lumbee youth would have the same FoK as the youths in my study.

Nevertheless, despite these limitations of my study, I feel I have documented what FoK these nine Lumbee American Indian youths brought to the HRE, and how these FoK allowed these youths to be significant contributors to this particular SCR CoP. Similar contributions by Lumbee youths have been documented elsewhere (Ash et al., 2015).

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APPENDIX A

PRE-TEST/POST-TEST FOR THE SCR HRE, 15-20 JULY, 2012

HERP Project members Dr. Catherine Matthews (UNCG), Dr. Terry Tomasek (Elon University), and Ms. Ann Somers (UNCG) developed this instrument.

Name: ____

Date: ____

HRE Location (please circle one): HHC SCR SSA

Matching. Please place the letter of the description on the right in the blank to the left of the most appropriate term in the column on the left.

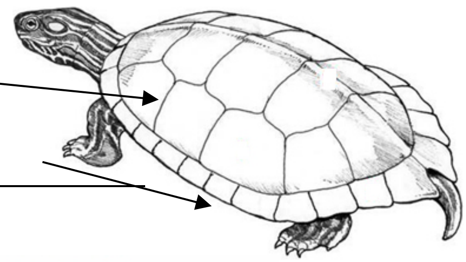
______ 1. Herpetology	A) Mostly lays eggs in water & has skin that is permeable to air & water
______ 2. Amplexus	B) Bony external plate or scale
______ 3. Vent	C) Order name for frogs and toads
______ 4. Anura	D) Has scaled skin
______ 5. Reptiles	E) Amphibians
______ 6. Bio-indicator Species	F) The study of amphibians and reptiles
______ 7. Frogs & Salamanders	G) Mating posture of frogs and toads
______ 8. Ephemeral or Vernal Pools	H) Temporary ponds
______ 9. Scute	I) Amphibians
______ 10. At different points in its life cycle, it might breathe with gills or lungs	J) Posterior opening for intestine, reproductive & urinary tracts

11. Name this calling animal (I will play a sound for you. Provide as much information as possible in your answer. Give a general name and a specific name if you can.)

12. Why do these animals call? (name as many reasons as you can)

13. How do you tell a male (♂) toad from a female (♀) toad?

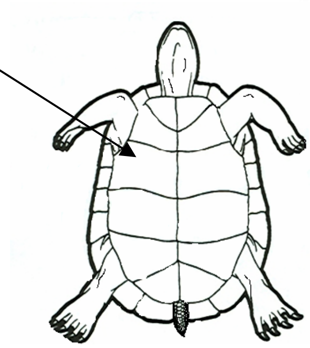
Label (with scientific terms) the indicated parts of a turtle.



14. (entire top shell) ________________

15. (sections of shell, along the edge of shell) ________________

16. (entire bottom shell) ________________



Answer the following questions with complete sentences or bulleted phrases:
17. How do scientists estimate frog populations in a given area?

18. List 3 ways you can distinguish <u>salamanders</u> from <u>lizards</u>.

a)

b)

c)

19. Label the images below.

____________________________ __________________________________

20. Temporary pools of water serve as homes or habitats for facultative and obligate species. What does this mean?

Fill in the chart to show three unique differences between reptiles and amphibians.

Reptiles	**Amphibians**
21.	
22.	
23.	

24. Name the venomous snakes in North Carolina. (Give common names and scientific names if you know them and list as many venomous snakes as you can.)

25. What is a mark/recapture study? What can we infer from this type of investigation?

26. If a box turtle weighed 320 grams in late May and 345 grams in late August, what percent weight gain has that animal experienced during the summer?

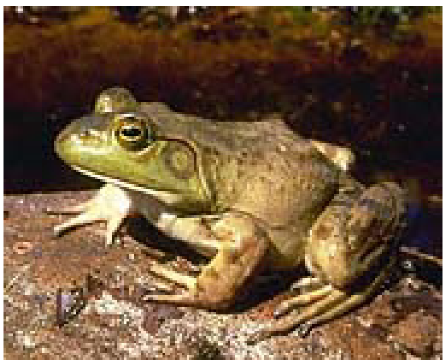
27. List at least three ways that you tell female box turtles from male box turtles.

a)

b)

c)

28. What kind of animal is this? [Do not use the field guide or classification key. Tell the common name, the scientific name and any other names that describe this animal.]



____

Match the following aquatic turtle species to an identification feature (field mark):

Musk Turtle; Painted Turtle; Snapping Turtle; Yellow Belly Slider

29. This turtle has a large head and a long, tapering tail with large scales on the top of the tail. ____________________________

30. This small turtle has a light yellowish line above the eye and another yellow line below the eye. ____________________________

31. This turtle has 2 yellow spots behind the eye and conspicuous red markings around the edges of the shell. The legs are striped with red. _______________________________

32. The bottom shell on this turtle is yellow, usually with a pair of dark spots on the gular plate. There is a yellow bar behind the eye that is sometimes faded in older adults. The legs are striped with yellow. ______________________________

33. How can GPS tools be helpful to field scientists?

Use your classification key and your field guide to answer the next two questions:

34. What is the common name for this animal? ___________________________________

35. What is the scientific name for this animal? __________________________________

Use the tools on your table to find the following measurements on your box turtle shell:

36. Top shell length _______________________

37. Mass _____________________

Match the name and descriptions to each picture:

38.  ___________ 39.  ____________

40.  ___________

41.  __________

42.  ___________

43.  ___________

Name	Description
A. MINNOW TRAP	H. Used to catch larger animals like turtles in a pond or a lake.
B. DRIFT FENCE	I. Used to measure the length, width, and height of a turtle's shell
C. DIP NET	J. Laid in the woods to attract snakes and salamanders
D. COVERBOARD	K. Dipped in water to collect creatures
E. SPRING SCALE	L. Used to weigh (mass) a frog or a salamander
F. TURTLE TRAP	M. Used to guide animals walking through the woods to go a certain way
G. CALIPER	N. Used to trap small animals like salamanders that live or spend time in the water

The graph below represents the increase in length (from tip of the nose to the cloaca) of the Southern Appalachian Woodland Salamanders over an average lifetime. After examining the graph below, please answer the following questions.

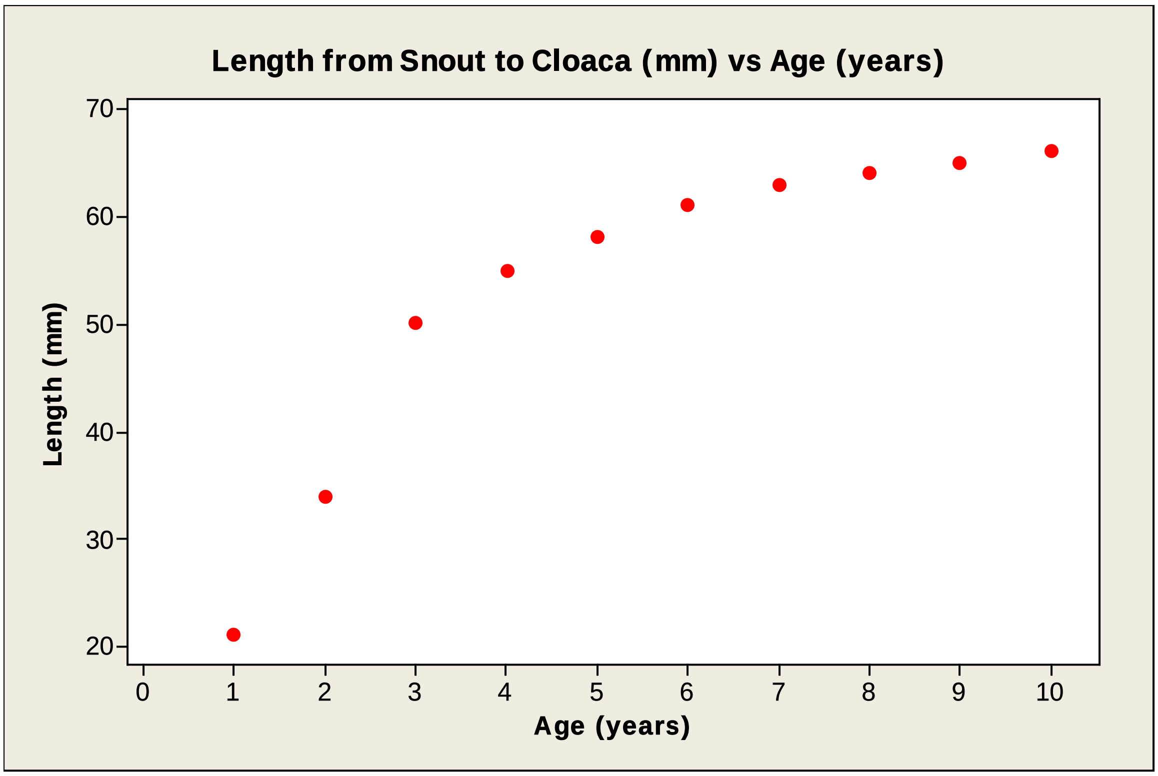
44. Is the growth of these salamanders constant throughout their lives (yes or no)? ___________

45. These salamanders become adults at three years of age. If you were developing a cutoff for identifying adults in the field, what length would you use as the minimum length for an adult animal? ______________

46. Do you think you can accurately age animals older than 7 years by their length alone? Why or why not?

____

____



APPENDIX B

PRE-SURVEY FOR THE SCR HRE, 15-20 JULY, 2012

The HERP Project's educational research team developed this survey. Dr. Heidi Carlone (UNCG) directed this team that was composed of Dr. Catherine Matthews (UNCG), Dr. Terry Tomasek (Elon University) and UNCG science education doctoral students.

Pre-Survey of Science Attitudes, Interests, and Experiences

Your Name ____

Rising Grade level: __________

HERP Project Location (please circle one): HHC SSA SCR

Background: Check all that apply. You can check more than one.

θ African American/Black/African
θ American Indian
θ Latino/Hispanic (Mexican, Cuban, South American, Puerto Rican, etc.)
θ White/Caucasian/European/European American
θ Asian/Asian American
θ Hawaiian/Native Hawaiian
θ Pacific Islander/Pacific Islander American
θ ________________________________ Please list any other ethnic background that applies

How would you describe where you live? (Check one)

θ Rural area ("in the country")
θ Suburban area ("outside of the city" or "not quite in the country")
θ Urban area ("in the city")

If none of the above describe where you live, how would you describe where you live?

____

____

Part I. Your previous science experiences

<u>Before</u> taking part in this herpetology research experience, have you ever: (Check either the "yes" or "no" box for each row)

	Yes	**No**
Attended a special science program?	o	o
Taken an extra school science class in the summer (not a make-up class)?	o	o
Participated in a science <u>fair</u>?	o	o
Participated in a science <u>club</u> or science <u>team</u>?	o	o
Received an award or special recognition for doing well in your science classes or other science-related activities (like a science fair, competition, etc.)?	o	o
Worked on a science project or experiment in a university or professional lab?	o	o
Had a teacher who made it exciting to learn science?	o	o
Had a teacher who made you dislike science?	o	o

Do you have any hobbies that you consider to be science related? o Yes o No

If you answered YES above, please list these science-related hobbies.

____

____

____

____

Before taking part in this herpetology research experience, did you ever do any of the following activities for fun or for other reasons that are not related to school? (Check one in each row)

	Yes, I did this before I participated in the HERP Project	I used to do this when I was younger, but I don't do it anymore.	I've never done this.
Read books about science or science fiction	o	o	o
Took care of or trained an animal	o	o	o
Visited a zoo, aquarium, science museum or planetarium	o	o	o
Talked with friends or family about science	o	o	o
Spent time outside in nature	o	o	o
Looked up science information in the library or on the Internet that was not required for school	o	o	o
Walked or hiked in the dark	o	o	o
Traveled outside of your community for significant amounts of time	o	o	o
Cooked	o	o	o
Used special science equipment (telescope, microscope, chemistry kit, magnifying lens, etc.)	o	o	o
Made models (airplane, dinosaur, house, etc.)	o	o	o
Held a reptile or amphibian	o	o	o
Used tools to build things	o	o	o
Collected rocks, butterflies, insects, or other things in nature	o	o	o
Took things apart (like motors, computers, toasters, etc.) to see how they work	o	o	o
Designed web pages	o	o	o

	Yes, I did this before I participated in the HERP Project	I used to do this when I was younger, but I don't do it anymore.	I've never done this.
Wrote stories about science or science fiction	o	o	o
Hunted or fished	o	o	o
Went camping	o	o	o
Looked at the stars, moon or planets	o	o	o
Watched weather or storms	o	o	o
Studied the clouds	o	o	o
Raised a farm animal	o	o	o
Grew vegetables or plants	o	o	o
Visited lakes, ponds, or streams	o	o	o
Waded or swam in a lake, pond, river, or stream	o	o	o
Worked outdoors	o	o	o
Collected wild berries, fruits, nuts, or leaves for food	o	o	o
Attended outdoor gatherings	o	o	o

Go to the next page.

Part II. Your views about science

How much do you agree or disagree with the following statements? (Mark one in each row)

	Strongly Disagree	**Disagree Somewhat**	**Neither Agree nor Disagree**	**Agree Somewhat**	**Strongly Agree**
I think science is interesting.	O	O	O	O	O
I am good at science.	O	O	O	O	O
I think I could be a good scientist.	O	O	O	O	O
Scientists spend most of their time working indoors or in labs.	O	O	O	O	O
Scientists have a chance to make a difference in the world.	O	O	O	O	O
Scientists can't be religious	O	O	O	O	O
Scientists don't have many other interests.	O	O	O	O	O
There are lots of jobs available in science.	O	O	O	O	O
Scientists have to work hard.	O	O	O	O	O
Science is a highly respected career.	O	O	O	O	O
Science is important to me.	O	O	O	O	O
You have to be a genius to be a scientist.	O	O	O	O	O
Scientists have to go to school for many years.	O	O	O	O	O
Scientists are mostly White	O	O	O	O	O

	Strongly Disagree	Disagree Somewhat	Neither Agree nor Disagree	Agree Somewhat	Strongly Agree
Scientists spend most of their time working by themselves.	O	O	O	O	O
I think like a scientist.	O	O	O	O	O
The media (television, movies, etc.) makes science seem cool.	O	O	O	O	O
Scientists make a lot of money.	O	O	O	O	O
Scientists are mostly men.	O	O	O	O	O
Scientists do not have many friends.	O	O	O	O	O

Which individuals have <u>most influenced the ways you think about science</u>? Please rank your choices 1-10, with 1 being most influential.

	Rank
Mother	________
Father	________
Sister/Brother/Other family member	________
School science teacher	________
Leader/teacher of other after-school or summer science experience	________
Clergy	________
Friends	________
Older community member	________
TV Personality (Write the name of the TV personality here): ____	_______

Part III. School and School Science

What were your grades for <u>all of your classes</u> this year in school? (Mark one)

- o Mostly A's
- o Mostly A's and B's
- o Mostly B's
- o A mix of A's, B's, and C's
- o Mostly B's and C's
- o Mostly C's
- o Mostly below C's

What was your final grade (average) in <u>MATH</u> class this year? (Mark one)

o A o B o C o Below C

What <u>MATH</u> class did you take this past year?

____

Which <u>SCIENCE</u> class(es) did take this past year (not including health classes)?

____

____

What was your final grade (average) in SCIENCE class this year? (Mark one)

o A o B o C o Below C

Part IV. Why did you choose to attend the Herpetology Research Experience?

1. **Circle the set of statements below that best explains why you're here today.**

2. **Underline one statement within that group that is the best match for the reason you're here today.**

My parent or guardian made me come

My friend made me come

This is a good way to spend time with or meet new friends

I wanted to learn about animals to help my family or friends

I came because I am curious

I am not an expert but I like to learn about things

Learning about animals is more interesting than what I might normally do in the summer

This is the kind of experience that people like me seek out

I wanted to try something new

I wanted to have fun

I wanted to hold a frog/turtle/snake for the first time

I wanted the opportunity to be brave

I feel a sense of awe when I am outside

This kind of experience makes me feel refreshed

This kind of experience helps me get away from the stresses of everyday life

This is the kind of experience that allows me to "unplug"

I was hoping to learn more about reptiles and/or amphibians than I already know

Reptiles and amphibians are my hobby

Being outside is my hobby

Thank you for taking this survey!

We appreciate you participating in this study. ☺

APPENDIX C

POST-SURVEY FOR THE SCR HRE, 15-20 JULY, 2012

The HERP Project's educational research team developed this survey. Dr. Heidi Carlone (UNCG) directed this team that was composed of Dr. Catherine Matthews (UNCG), Dr. Terry Tomasek (Elon University) and UNCG science education doctoral students.

THE HERP PROJECT

Post-Survey of Science Attitudes, Interests, and Experiences

Your Name ____

Rising Grade level: __________

HERP Project Location (please circle one): HHC SSA SCR

Part I. Reflect on the herpetology research experience

Participating in this herpetology research experience increased my:

	1: "not at all"	2	3	4	5: "a lot"
Knowledge of science	o	o	o	o	o
Confidence in doing science	o	o	o	o	o
Interest in science	o	o	o	o	o
Interest in nature	o	o	o	o	o
Abilities to use scientific tools	o	o	o	o	o
Interest in participating in other science experiences	o	o	o	o	o
Understanding of threats that reptiles and amphibians face	o	o	o	o	o
Connection to nature	o	o	o	o	o

	1: “not at all”	2	3	4	5: “a lot”
Empathy for animals	o	o	o	o	o
Awareness of career choices in science or a related field	o	o	o	o	o
Connections to people in science or related fields	o	o	o	o	o
Understanding of what people in science-related jobs or careers do	o	o	o	o	o
Desire to find a science-related job/career	o	o	o	o	o

Go to the next page

Participating in this herpetology research experience made me feel:

	1: "not at all"	2	3	4	5: "a lot"
Confident to try new things	o	o	o	o	o
Like a science person	o	o	o	o	o
More aware of my strengths and weaknesses	o	o	o	o	o
Brave	o	o	o	o	o
Interested in taking care of the environment	o	o	o	o	o
That I have a good future ahead of me	o	o	o	o	o
That I could be good at science or a related field	o	o	o	o	o
Connected to living things in my local environment	o	o	o	o	o
Curious about nature	o	o	o	o	o
Successful	o	o	o	o	o

Participating in this herpetology research experience made me <u>feel like it is possible for me to:</u>

	1: "not at all"	**2**	**3**	**4**	**5: "a lot"**
Think like a scientist	o	o	o	o	o
Talk like a scientist	o	o	o	o	o
Teach others about reptiles and amphibians	o	o	o	o	o
Be seen as smart in science	o	o	o	o	o
Help my friends get good grades in science next year	o	o	o	o	o
Use what I know about science outside of school	o	o	o	o	o
Study science in college	o	o	o	o	o
Contribute to science	o	o	o	o	o
Think about joining a science-related club or group	o	o	o	o	o
Start a science hobby	o	o	o	o	o

Go to the next page.

In this herpetology research experience:

	1: “not at all”	2	3	4	5: “a lot”
I felt ignored	o	o	o	o	o
Other HRE participants asked for my suggestions and ideas	o	o	o	o	o
People thought I was a science person	o	o	o	o	o
I felt “out of place”	o	o	o	o	o
Other HRE participants liked to work with me	o	o	o	o	o
My friends thought it was cool to answer questions	o	o	o	o	o
My friends thought it was ok to ask for help if they needed it	o	o	o	o	o
My friends thought it was cool to be really smart in science	o	o	o	o	o
The professors, project leaders, and/or other scientists considered me to be good in science	o	o	o	o	o

How much do you agree with the following statements related to the herpetology research experience?

	1: “not at all”	2	3	4	5: “a lot”
I enjoyed learning science	o	o	o	o	o
I had to work hard to understand the material	o	o	o	o	o
The students who did well in this HRE had special talent in science	o	o	o	o	o
It was important to me that I tried my hardest	o	o	o	o	o
I learned how to accurately use tools to collect data about reptiles and amphibians	o	o	o	o	o

What did you like best about this herpetology research experience?

What would you change about this herpetology research experience?

Thanks so much for your time! We appreciate it! ☺

APPENDIX D

DAILY SCHEDULES FOR THE SCR HRE, 15-20 JULY, 2012

	Sunday, 15 July 2012		
Time	**Activity**	**Personnel**	**Location**
10:00	Staff arrival, check-in, training, (most staff should have arrived 14 July or prior)	All staff	Dining Hall
10:30			
11:00	Equipment preparation, set traps, etc.		
11:30			
12:00	Participant check-in	HERP staff under the direction of Andy, Kathy	
12:30		David Weber, HRE Staff under the direction of Andy, Kathy	Dining Hall
13:00	Parent coffee		
13:30			Dining Hall
14:00	Participants move materials to cabins (Counselors)	Camp Counselors	
14:30	Participant testing, interviews	HERP Staff	Dining Hall
15:00	Alternative activity in recreational area for test finishers		Dining Hall, recreational area
15:30			
16:00	General introduction to camp, dos and don’ts,	Intro, venomous animals – Kathy, Andy, Ann	
16:30	Venomous animals, dichotomous keys, go over		Dining Hall
17:00	schedule for week, safety session, field notebooks		
17:30	Participants settle in, prep for dinner	Camp Counselors	Cabins
18:00	Dinner		Dining Hall
18:30			
19:00	HERP elective	Electives coordinators	Science Hut
19:30			
20:00			
20:30	Introduction TO HERP	Jeff Hall	Science Hut
21:00	Night walk, learn frog calls		SCR campus
21:30			
22:00			
22:30	Release to cabins (participants)	Camp Counselors	Cabins

	Monday, 16 July 2012		
Time	**Activity**	**Personnel**	**Location**
8:00	Breakfast, cabin cleanup, nametag	Camp Counselors	Dining Hall
8:30	Fill water bottle, prepare backpack with gear	Staff meeting	Science Hut
9:00	HERP Morning Field Activity		SCR Campus
9:30	Group 1 - Stream Amphibians, Group 2 - Lizards, Group 3 - Box Turtles, Group 4 - Aquatic Turtles, Group 5- Snakes	Erika Dubreuil, Aubrey Meadows, Lacey Huffling, Hayley Hegedus, Kat Walston, John Rucker, Ann Somers, Kevin Durso	Activity Sites
10:00			
10:30			
11:00			
11:30			
12:00	Morning Group Stories	HERP Staff, Participants	Science Hut
12:30	Lunch	Camp Counselors	Dining Hall
13:00	Camp Activity 1 - Swimming test	Camp Counselors	SCR Campus
13:30			
14:00	Swimming test		
14:30			
15:00	Camp Activity 2	Camp Counselors	
15:30			
16:00			
16:30			
17:00	Rest Time	Camp Counselors	Cabins 9, 10
17:30	Cleanup for Dinner		
18:00	Dinner		Dining Hall
18:30			
19:00	Field notebook transcription	HERP Staff, Participant Groups	Dining Hall
19:30	Introduction to CASP	Jeff Hall	Dining Hall
20:00			
20:30	CASP Night walk	Jeff Hall, Group Leaders	SCR Campus
21:00			
21:30			
22:00	Release to cabins (participants)	Camp Counselors	Cabins 9, 10
22:30			

	Tuesday, 17 July 2012		
Time	**Activity**	**Personnel**	**Location**
8:00	Breakfast, cabin cleanup, nametag	Camp Counselors	Dining Hall
8:30	Fill water bottle, prepare backpack with gear	Staff meeting	Science Hut
9:00	HERP Morning Field Activity		SCR Campus
9:30	Group 5 - Stream Amphibians, Group 1 - Lizards, Group 2 - Box Turtles, Group 3 - Aquatic Turtles, Group 4- Snakes	Erika Dubreuil, Aubrey Meadows, Lacey Huffling, Hayley Hegedus, Kat Walston, John Rucker, Ann Somers, Kevin Durso	Activity Sites
10:00			
10:30			
11:00			
11:30			
12:00	Morning Group Stories	HERP Staff, Participants	Science Hut
12:30	Lunch	Camp Counselors	Dining Hall
13:00	Camp Activity 1	Camp Counselors	SCR Campus
13:30			
14:00			
14:30			
15:00	Camp Activity 2	Camp Counselors	
15:30			
16:00			
16:30			
17:00	Rest Time	Camp Counselors	Cabins 9, 10
17:30	Cleanup for Dinner		
18:00	Dinner		Dining Hall
18:30			
19:00	Field notebook transcription	HERP Staff, Participant Groups	Dining Hall
19:30	HERP Electives	Elective Groups	Dining Hall/ Environmental Hut
20:00			
20:30			
21:00	Night walk	Group Leaders	SCR Campus
21:30			
22:00	Release to cabins (participants)	Camp Counselors	Cabins 9, 10
22:30			

	Wednesday, 18 July 2012		
Time	**Activity**	**Personnel**	**Location**
8:00	Breakfast, cabin cleanup, nametag	Camp Counselors	Dining Hall
8:30	Fill water bottle, prepare backpack with gear	Staff meeting	Science Hut
9:00	HERP Morning Field Activity		SCR Campus
9:30	Group 4 - Stream Amphibians, Group 5 - Lizards, Group 1 - Box Turtles, Group 2 - Aquatic Turtles, Group 3- Snakes	Erika Dubreuil, Aubrey Meadows, Lacey Huffling, Hayley Hegedus, Kat Walston, John Rucker, Ann Somers, Kevin Durso	Activity Sites
10:00			
10:30			
11:00			
11:30			
12:00	Morning Group Stories	HERP Staff, Participants	Science Hut
12:30	Lunch	Camp Counselors	Dining Hall
13:00	Camp Activity 1	Camp Counselors	SCR Campus
13:30			
14:00			
14:30			
15:00	Camp Activity 2	Camp Counselors	
15:30			
16:00			
16:30			
17:00	Rest Time	Camp Counselors	Cabins 9, 10
17:30	Cleanup for Dinner		
18:00	Dinner		Dining Hall
18:30			
19:00	Field notebook transcription	HERP Staff, Participant Groups	Dining Hall
19:30	Introduction to nature photography	Jeff Hall	Dining Hall
20:00			
20:30	Reptile and amphibian photography	Wayne and Amy Van Devender	Dining Hall
21:00			
21:30			
22:00	Release to cabins (participants)	Camp Counselors	Cabins 9, 10
22:30			

	Thursday, 19 July 2012		
Time	**Activity**	**Personnel**	**Location**
8:00	Breakfast, cabin cleanup, nametag	Camp Counselors	Dining Hall
8:30	Fill water bottle, prepare backpack with gear	Staff meeting	Science Hut
9:00	HERP Morning Field Activity		SCR Campus
9:30	Group 3 - Stream Amphibians, Group 4 - Lizards, Group 5 - Box Turtles, Group 1 - Aquatic Turtles, Group 2- Snakes	Erika Dubreuil, Aubrey Meadows, Lacey Huffling, Hayley Hegedus, Kat Walston, John Rucker, Ann Somers, Kevin Durso	Activity Sites
10:00			
10:30			
11:00			
11:30			
12:00	Morning Group Stories	HERP Staff, Participants	Science Hut
12:30	Lunch	Camp Counselors	Dining Hall
13:00	Post Tests, Post Interviews	HERP Staff, Educational Researchers	Dining Hall, Recreation Area
13:30			
14:00			
14:30			
15:00	Camp Activity 2	Camp Counselors	SCR Campus
15:30			
16:00			
16:30			
17:00	Rest Time	Camp Counselors	Cabins 9, 10
17:30	Cleanup for Dinner		
18:00	Dinner		Dining Hall
18:30			
19:00	Field notebook transcription	HERP Staff, Participant Groups	Dining Hall
19:30	Electives	HERP Staff	Dining Hall, Environmental Hut
20:00			
20:30			
21:00			
21:30			
22:00	Release to cabins (participants), Pack for Departure	Camp Counselors	Cabins 9, 10
22:30			

	Friday, 20 July 2012		
Time	**Activity**	**Personnel**	**Location**
8:00	Breakfast, cabin cleanup, nametag	Camp Counselors	Dining Hall
8:30	Fill water bottle, prepare backpack with gear	Staff meeting	Science Hut
9:00	HERP Morning Field Activity		SCR Campus
9:30	Group 2 - Stream Amphibians, Group 3 - Lizards, Group 4 - Box Turtles, Group 5 - Aquatic Turtles, Group 1- Snakes	Erika Dubreuil, Aubrey Meadows, Lacey Huffling, Hayley Hegedus, Kat Walston, John Rucker, Ann Somers, Kevin Durso	Activity Sites
10:00			
10:30			
11:00	Morning Group Stories	HERP Staff, Participants	Dining Hall
11:30	11:15 Participants to Cabins, collect gear, move to Dining Hall, prepare for departure		
12:00	Departure	HERP Staff, Participants	Dining Hall

APPENDIX E

YOUTH INTERVIEW PROTOCOL FOR THE SCR HRE, 15-20 JULY, 2012

The HERP Project's educational research team developed this interview prtocol. Dr. Heidi Carlone (UNCG) directed this team that was composed of Dr. Catherine Matthews (UNCG), Dr. Terry Tomasek (Elon University) and UNCG science education doctoral students.

YOUTH INTERVIEW PROTOCOL

SUMMER 2012

HERPETOLOGY RESEARCH EXPERIENCE (HRE)

(END OF WEEK/EXPERIENCE)

Introduction: Say something like: "I want to talk with you so that I can learn more about your thoughts and feelings about the herpetology research experience (hereafter, HRE) you participated in and about science in general. I also want to learn more about some of the things that you are interested in outside of school. I am recording our conversation so that I do not miss anything important. Is that ok with you?"

<u>PART 1. REFLECTIONS ON THE HRE</u>

This part of the protocol should be quick! Don't do too much probing.

1. Describe **you** during the herpetology research experience with three words.

   - Probe "why" for each word.

2. Let's say that you're going to do an activity with your herps group. How did you contribute to your group?

   - Get them to try to answer this w/o any examples.
   - If they don't have any ideas for how they contributed, offer some of these choices as examples: person who got all the materials, data materials, first to volunteer, recorder, materials person, question-asker, photographer, person who noticed important things, person who often had an idea different from the rest of the group.
   - "Why?"

3. Now, rather than thinking of working with just your group, think of everyone who studied reptiles and amphibians at SCR.

   - What contributions do you think you made to *everyone's* study of reptiles and amphibians this week at SCR?

   - What skills or characteristics do you have that helped you make those contributions?

     - If students ask about what a skill is: A skill is something that you are able to do. For example, a skill might help you get things done, help you solve problems, or to help you help other people.
     - If students ask about what a characteristic is: A characteristic is something special about you that makes you who you are.

   - What skills or characteristics have you developed this week that will help you when you return home & how will these skills or characteristics help you?

4. Think about **a HERPS activity** (from this summer) where you were particularly **proud of yourself**. (This would be something where you felt really, really good about what you did).

- Describe that project/activity (briefly—what did you do? Who did you do it with? Where?)
- Why did that project/activity allow you to feel proud of yourself?
- Is this project the same or different to something that would make you proud in school science?

5. If I were to ask you to name the **3 smartest kids** in the herpetology research experience this summer, whom would you name?

- Why?
- What characteristics do these people have that make you say they were smart in the herpetology research experience? [You may want to separate out each person/go through individually.]
- Do you share any of those characteristics? Which ones? Why not others?

PART II. REFLECTIONS ON SCHOOL SCIENCE THIS YEAR

This part of the protocol should be quick! Don't do too much probing. Tell youth that you're switching gears to quickly discuss their school science experiences from this past year.

1. Describe **you** in your <u>science class at school</u> during this past school year with three words.

- Probe "why" for each word.

2. Think back to last school science last year. Let's say that you were going to do a science activity with a group at school. How did you contribute to your group?

- Get them to try to answer this w/o any examples.
- If they don't have any ideas for how they contributed, offer some of these choices: person who got all the materials, data materials, first to volunteer, recorder, materials person, question-asker, photographer, person who noticed important things, person who often had an idea different from the rest of the group.
- "Why?"

4. If I were to ask you to name **3 smartest science students** in your class at school during this past year, who would you name? (*The names are not as important as the characteristics they discuss. You're trying to get them to define what counts as "smart" in school*).
   - Why?
   - What characteristics do these people have that make you say they are good in science? [*You may want to separate out each person/go through individually*.]
   - Do you share any of those characteristics? Which ones? Why not others?

PART III. THE HRE NORMS AND VALUES CARD SORT

Script: *We have three HREs happening across the state. They each may be run slightly differently, and we want to find out more about the kinds of things that were a regular part of this HRE you did and the kinds of things that your HRE leaders expected from all of you. These cards contain statements about things* *that may or may not have been a regular part of HRE and that the project leaders may or may not have expected from all of you.*

FIRST TASK: Read each statement on the card. Decide whether or not this was something that you were expected to do regularly in the HRE. Place the card in the Yes, Maybe, No pile.

- **Probes: Get them to describe the card with at least one sentence: What does this card mean for this HRE?**
- **Can you give me an example? [or Why did you not have to do that? (if in "no" pile)].**
- **You want to remind them throughout the task that they're describing the HRE practices, not "science's" practices in the broader sense.**
- **Your goal is to get at THEIR meanings of the practices listed on the cards as the practices relate to this HRE.**

SECOND TASK FOR THE "YES" PILE ONLY: Choose three cards that represent the most important activities in the HRE overall—these are the activities that the project leaders ***really*** wanted you to do, that they held you accountable for doing.

- **Probes: Why was this a top 3? How important was it to you to do these things well? How important is it for "real scientists" to do these things well?**

THIRD TASK FOR THE ENTIRE PILE: Out of all of the cards, choose three cards that would be the most important activities for an outdoor science learning experience that you would design. Explain your choices.

- **Probes: What kind of learning experience were you thinking of when you chose these cards? Why these cards?**

Other points:

- Make sure you have the cards in the same order (they will be numbered) for every interview.

Card Statements

- Make careful observations
- Collect data
- Help others
- Talk like scientists
- Know a lot of science facts
- Think like scientists
- Ask questions
- Discuss science as a tool to help people or the environment
- Make mistakes (may want to re-word from “being held accountable” to “it being ok”)
- Be curious
- Use scientific vocabulary
- Work through fear
- Use scientific tools
- Be precise or accurate

PART IV. PORTRAYALS OF SELF IN HRE AND AT SCHOOL

These should be short. Probe only for * questions unless absolutely compelling.

☺ The probes should be SHORT.

A. HRE/SCHOOL QUESTIONS

For the following questions, I want you to think about yourself in the HRE (there are a couple questions about school, too). These are basically fill-in-the-blank questions. Tell me how you’d fill in the blank.

- I was at my best in the ___________ study at the HRE (box turtle, snake, aquatic turtle, vernal pool, stream salamander, HRE elective)

  (Probe: What's "your best"? Why this research experience?)

- At school, my teachers would describe me as a ___________________ kind of person.
- In the HRE, the project leaders would describe me as a __________________ kind of person.
- In school, I get most excited about ____.
- At the HRE, I got most excited about __________________________________.
- In school, I get most bored with ____.
- At the HRE, I got most bored with ____________________________________.
- The hardest part about the HRE has been _______________________________.
- The easiest part about the HRE has been _______________________________.
- The best part about the HRE has been _________________________________.
- The worst part about the HRE has been ________________________________.
- If I could make any changes to the HRE, I would ______________________.

- Three words to describe the HRE this summer: ________________________,

  ____________________, and ___________________________.

B. Future Plans Questions

For the following questions, I want you to think about yourself out of school. After you answer the first question, the other questions will be fill-in-the- blank questions.

- What do you think is the most important skill that you learned as a result of growing up in your community from a family member, a friend, a church member, or an older adult in the community?
    - Possible answer probes: skills that have made you a better person, helped you to help your friends or family, or helped you to be a better member of your community.

- *Again, the following questions are basically fill-in-the-blank questions. Tell me how you'd fill in the blank.*

- When I grow up, I imagine myself being a ____________________ kind of person. (Leave it open for their descriptions).

- When I grow up, I imagine myself being really good at doing these kinds of things: ____.
  (Leave it open for them to decide, per Lynn D's suggestions—a good organizer, a good mother, nurturing, teaching, leading, running things…probe for kinds of roles the imagine themselves playing).

- When I grow up, I want to be a
  ____.
  (Probe for all the career paths they've envisioned for themselves).

- To achieve that goal (the thing they want to do when they grow up, listed above), I will have to
  ____.
  (Probe for all the things they think they'll have to do… try not to give them any suggestions, ok? I want to get their ideas about what it takes to achieve goals of future selves).