# Learning Mathematics in Central Appalachia:
# Life Histories of Beginning Elementary Teachers

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Dissertation submitted to the Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY
in
Curriculum and Instruction

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September 7, 2005
Blacksburg, Virginia

Key Words: Appalachia, life stories, mathematics education, *Praxis I* Mathematics, rural poverty

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(ABSTRACT)

Life stories were constructed for three young women from Appalachia to explore their mathematics experiences as students in public schools of the region. Data sources included interviews, school records, and a self-drawn chart of estimated mathematics ability for each year, from kindergarten through twelfth grade. A cross-case analysis revealed similar characteristics among the three women including shyness, difficulty with middle school mathematics and with high school geometry, the choice not to take a mathematics course in the last year of high school, and an awareness of a negative Appalachian stereotype. The mathematics education received by all the women was inadequate as demonstrated by their self-created graphs, their life story accounts, and their initial difficulties in making the minimum required score on the *Praxis I* Mathematics test. Their subsequent successes in graduating from college can be attributed to their own motivation and tenacity in addition to the encouragement of their families and some teachers.

Connections to *Standards*-based reform in mathematics education include questions about the teaching and learning of geometry and about opportunities for students, especially females, to participate in mathematical discourse throughout their school mathematics experiences, a situation impacted by their expressed shyness and by overt and subtle incidences of gender and racial biases. Appalachian cultural connections seem to be an aspect of fatalism which influences attribution of natural ability versus effort and, in some instances, a climate of male dominance. Connections to the problems of education in rural poverty included a number of ineffective teachers, a situation exacerbated by a sense of social stratification within the Appalachian culture and a reluctance to challenge school or teacher practices. As for learning preferences, the women tended to favor teachers who offered good explanations and who demonstrated caring, which highlights an emphasis placed on relationships within the Appalachia culture.

Determining the degree of influence of the Appalachian culture on the education, especially in mathematics, of these three young women was difficult to ascertain. The factors of culture, socioeconomic levels, and rural isolation combined with the effects of race, gender and ethnicity in the individual to impact the opportunities to a quality education.

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# Acknowledgements

My life story is made rich by those who have walked behind me, beside me, and in front of me, contributing in large and small ways to the narrative of my life. I dedicate this work to the memory of my mother and father, Louis and Macie Hardy, whose faith in God, hard work, and belief in the value of education became the basis for my beliefs and choices. Their sacrifices brought me countless blessings. I also dedicate this work in memory of my husband, Wade T. Watson, whose love of knowledge, along with his indomitable faith and courage in the darkest of times, continues to inspire me. And I dedicate this work to the memory of my great-niece, Heather Smith, whose life story was tragically shortened, yet she taught me love, loyalty, and youthful perspective.

God has blessed me in so many ways, but especially with family and friends who have helped me to reach my goals and dreams. I'm grateful for my brother and sister-in-law, Dennis and Janice Hardy, and their family, whose love and support mean more than they know. For the people who make up the Division of Education at Bluefield College, I offer my heartfelt thanks. Dr. Gerald Clay, my professor in 1979-1980 and now a colleague, provided me opportunities and challenges to learn about teacher education, and made it possible for me to teach at Bluefield College while going to graduate school. Dr. Ethel Haughton shared her experiences at Virginia Tech and encouraged me to pursue this dream. Jennifer Thorn helped me in more ways than I could list; her friendship and support were invaluable. Nora Lockett, whose library expertise and humor I always counted on, often saved the day. And a friend from my hometown, Harriet Billings, continues to help me in a number of practical ways. For all my other friends, family, and church family who have encouraged and prayed for me, I am grateful.

This research would not have been possible without the individuals in my study who were so generous with their time and forthcoming with their memories, and I gratefully acknowledge them. In addition, I was privileged to teach for 16 years in my native McDowell County, West Virginia, an area of rural poverty, and I am thankful for the lessons I learned from those students; they provided the background for everything I learned after that. During the latter of those years teaching public school, I was blessed to work with Mrs. Barbara Justice, a mathematics instructional aide; I would like to thank her for all the learning strategies and ways of caring for students that she shared with me. I would also like to thank my own wonderful public school teachers whose level of dedication was unsurpassed, especially my elementary school teachers, Mrs. Lois Sheets, Mrs. Helen Booth, and the late Mrs. Marguerite Grubb, and my high school English teacher, Mrs. Marie Lawson.

I offer my heartfelt thanks to my dissertation committee members who wisely saw my true research calling. They challenged me to grow in sometimes difficult ways, but their encouragement and feedback brought me to this place, as they generously shared with me their time and insights. My co-advisor, Dr. Susan Magliaro, broadened my ideas on teacher education research and education theories in her classes, and helped me refine my research through the sharing of her valuable wisdom and knowledge of resources. My co-advisor, Dr. Jesse Wilkins helped me to see my research within the broader theme of quantitative literacy and increased my learning experiences within his classes by connecting them to my research interests. Dr. Gwendolyn Lloyd helped me gain a perspective about the history of mathematics reform and freely shared her research expertise to me with countless conversations and feedback. Dr. Penny Burge expanded my knowledge of research methods and the potential to promote social justice through inquiry while helping me to strengthen my research writing skills. All of the professors

in my course work at Virginia Tech provided intriguing ideas and practical information: every course connected in some way to my teaching experiences or to my research. I am also truly grateful to all my colleagues in the doctoral program at Virginia Tech who read chapters and gave feedback, provided encouragement and support, and kept me informed on important deadlines and requirements.

Finally, I thank God for His love and for my Appalachian heritage which, in my view, means kinship and community ties, a sense of place, an unwavering faith in God, the courage to overcome obstacles, and a home among the West Virginia hills. I can say, along with the ancient psalmist, "I will lift up mine eyes unto the hills, from whence cometh my help. My help cometh from the LORD, which made heaven and earth. He will not suffer thy foot to be moved: he that keepeth thee will not slumber," Psalm 121: 1-3 (KJV).

# Chapter One

## Introduction

"Most Puerto Rican, Negro, Mexican-American, and Appalachian white children are retarded in reading. Not *many*, but *most*. Many educational administrators are kidding themselves by not recognizing and accepting the magnitude of the problem" (Cohen, 1967, p. 40).

As a native Appalachian, I was attending elementary school in 1967 when Cohen wrote those words, and I was unaware that outsiders viewed me as most likely retarded in reading. The teachers in my elementary school were not of the same dire opinion because they taught me and my classmates to read, write, and do mathematics with two grade levels of students in each room. With gratitude for those teachers, I continued my education, earning a bachelor's and a master's degree, becoming a middle school mathematics teacher in Central Appalachia. Throughout my college courses and my teaching experience, I became acutely aware of many obstacles to education that students in this geographic area face and the tremendous influences that teachers have on the lives of their students.

### *Education for All*

In the United States, efforts at educating all citizens have evolved from compulsory education to desegregation to the present No Child Left Behind legislation. Yet over a 200-year span, predictable patterns in educational achievement for certain groups of students remain mostly static in relation to race, ethnicity, language, and social class. In mathematics education, where reforms to improve teaching and learning have been implemented, all scores from the National Association for Educational Progress [NAEP] show improvement in the last 10 years (National Center for Education Statistics, 2003). However, a persistent achievement gap exists in mathematics between Whites/Asians and Blacks/Hispanics, between Students Not Eligible for Free/Reduced Lunch and Students Eligible for Free/Reduced Lunch, and between Students from Rural/Small Town/Urban Fringe/Large Town and Students from the Central City (National Center for Education Statistics). Among these groups and in all grades, poverty is most closely aligned with lower student achievement in mathematics, and school level poverty may even surpass individual level of poverty as a predictor (Secada, 1991).

### *Current Research on Mathematics Education in Appalachia*

Educational research on poverty has taken many forms from viewing poverty through a deficit model of the disadvantaged, culturally deprived, or at-risk to a more respectful culturally inclusive one (J. A. Banks, 2004). Dilworth and Brown (2001) suggest viewing the various disenfranchised groups as "culturally rich" (p. 643), connecting poverty and lower social class to Black, Hispanic, and Native Americans communities. One "community" that is profoundly affected by poverty but is noticeably missing from this and most research on poverty in education is that of Central Appalachia[1]. In studying the region's development possibilities, Glasmeir and Farrigan (2003) made this dire assessment:

[1] A sub-region of Appalachia designated by the Appalachian Regional Commission as having similar topological, economic, and demographic characteristics. Counties in southern West Virginia (including Mercer and McDowell), southwest Virginia (including Tazewell), eastern Kentucky, and northeastern Tennessee have a higher poverty rate

> Conditions in Central Appalachia are by any measure bleak. There are few jobs, the environment has been significantly degraded, and despite thirty years of government involvement, very little has changed. Citizens still live in a state of permanent impermanence, land ownership is continually contested, the natural resource-based economy is in a persistent state of decline, and political cronyism is still the major means by which decisions are made. (p. 146).

Harrington (1962) drew attention to the "invisible poor" in America by describing poverty throughout the nation to a middle class society, bringing to the public eye the struggles of their impoverished neighbors. He contrasted the natural beauty of Appalachia with the persistent poverty, limited economy, and hopelessness of the people. Sarnoff (2003) revisited Harrington's assessment of Central Appalachia 40 years later and found this rural area to be suffering even more from the effects of the poverty while the plights of Northern and Southern Appalachia had improved somewhat. Along with the substandard housing, inadequate health care, insufficient infrastructure, and limited job opportunities, schools may be unable to meet the needs of their students. An Appalachian Regional Commission [ARC] Economic Overview acknowledged improvement in educational attainment but "considerable educational deficits remain, particularly in central Appalachia where the average high school completion rate for this age group [ages 18-24] is only 68 percent" ("Educational Trends," n.d., ¶8).

The poor in Appalachia share characteristics with those in other rural areas such as ties to family and place, but Appalachian students must endure a unique stereotype: the "hillbilly" image found in television programs such as *The Beverly Hillbillies*, comic strips such as *Snuffy Smith*, movies, news stories, and even marketing strategies.[2] Appalachians have also been characterized as "educationally disadvantaged," "not much interested in schools or schooling," and "suspicious of the motives of those who offer help" (Crow, Murray, & Smith, 1966, p. 21) by education professors who blamed low academic achievement upon students and their families. Many Appalachians, who had the opportunity to go to college or move to another region, hid their origin for fear of not being accepted within the mainstream, or worse, being humiliated in front of peers (Billings, Norman, & Ledford, 1999; Dyer, 1998; Speer, 1993). Others grew up submersed in the Appalachian culture, but never being taught its richness and depth, they learned to devalue it by its very absence in the connections to subjects they learned in school (Palencia, 1998). Even Appalachians who out-migrated[3] to urban areas retain a marginalized status: "Similarly an urban Indianapolis teacher insidiously confided, 'These city hillbilly kids are the *real* bottom of the barrel, if you know what I mean'" (Heilman, 2004, p. 67).

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(27%), higher unemployment rate, and higher dropout rate than the Northern and Southern sub regions. (Appalachian Regional Commission, n.d.)

[2] In 2004, West Virginia Governor Bob Wise protested the sale and distribution of a T-shirt with the slogan, "It's All Relative in West Virginia" by Abercrombie & Fitch because it promoted "an unfounded, negative stereotype" of the state (*USA Today*, ¶2).

[3] Out-migration refers to Appalachians moving out of the Appalachian region, usually to urban areas to find employment (Crouch, 2002; Towers, 2005). Once in this new location, they tend to remain in close kinship and cultural groups with an Appalachian identity (Heilman, 2004, Owens, 2000).

*Research on Mathematics Education in Areas of Rural Poverty*

Just as the Appalachian culture is primarily missing from the marginalized group connections in educational literature, the rural poor go unnoticed in much of the literature on poverty. Haberman (1995) interviewed a number of teachers from urban schools who were particularly successful with students from poverty, noting what they did and did not do that was different from teachers who were primarily successful with only the mainstream students. "For the children and youth in poverty from diverse cultural backgrounds who attend urban schools, having effective teachers is a matter of life and death. For them, the stakes involved in schooling are extremely high" (p. 1). This statement is equally true for students in rural poverty, especially those who reside in Central Appalachia.

Kozol (1991) in *Savage Inequalities* described with graphic detail the disgraceful state of schools attended by America's urban poor. Schools in various states of disrepair, lacking rudimentary supplies, served needy children with outdated textbooks, little or no resources, and few qualified teachers. The grim portrait he painted of schools was offset by conversations with eager students who expressed dreams in spite of honest assessments of their plight. Kozol noted a particular Cincinnati school as having "a kind of poverty I'd never seen before" where most of the children were "poor Appalachian whites who'd settled in this part of Cincinnati…and led their lives in virtual isolation" (p. 229). The children at this school had reading and math scores even lower than those at the other inner city schools. Kozol did not venture outside of city schools to find educational inequalities, but many of the portraits he painted reminded me of places where I had taught in Central Appalachia, in buildings needing repair, with limited supplies, and problems disregarded by those with political power.

In an effort to show public education in a more positive light, Rose (1995) visited schools in eight states and reported in rich detail promising practices and policies where students were learning and cultures were valued. In Appalachia, Rose visited a teacher education program at Berea College and a high school in Wheelwright, Kentucky. Although he honestly described the devastating effects of the decline of the coal industry on the area, and on the students, he portrayed the teachers in a valiant struggle to prepare the students to leave the area while retaining their sense of identity. As one high school teacher expressed:

> I want them to know about their history… I want them to take pride in the people who settled the area, who worked hard and wanted the most for their children. I suppose I want them to have a sense of place. (p. 278)

Over half of the high school students at Wheelwright were on public assistance. Even though no easy answers were given, seen through Rose's eyes, the questions and dreams of the teachers for the students with the respect for the area presented this Appalachia school affirmatively.

Other researchers have studied underserved students in regards to literacy and language skills. Examining contemporary methods of teaching writing to African American children, Delpit (1995) raised issues about emphasizing process over skills which she believed to be detrimental. She discussed the concept of language register[4] and the differing ways that students

[4] Language register denotes a predictable variation in terms of vocabulary, semantic structure, and expression according to different contexts and subjects. Payne (2001) suggested that the lower class home register may be different from that of the middle class school register. Zevenbergen (2000) described a mathematics register with three components: "the specialized vocabulary of mathematics, the semantic structure, and the lexical density of mathematics" (p. 205).

who are out of the mainstream culture respond to teachers who are part of and who perpetuate the middle class. Rose (1989) described his own journey to be college-educated even though he was from an educational underclass, poorly prepared for college. He discussed coping strategies that he and his friends employed to successfully navigate school and how he became enamored with language and writing. He used his own background as reference to tell stories about teaching urban students like Rose himself to write and to love literature. The teaching of writing from the rural viewpoint can be found in a 1998 account of 8 teachers in Nebraska who, through the National Writing Project, integrated place-conscious education into their English curriculum and teaching methods (Brooke, 1998). Tenets with possible ties to the Appalachian culture included a sense of place, of civic involvement, of worth, of connection, and of belonging.

One study of emergent literacy involved a poor displaced Appalachian family in an urban setting. Purcell-Gates (1995) gathered research as she taught a woman and her young son to read. While the teachers in the public school treated the mother with contempt, Gates presented her in a heroic light. Descriptions of the family life clearly showed the dominance of the Appalachian culture in both negative and positive ways. Heath (1983) studied the language development of two working class families in North Carolina, very close to the southern regions of Appalachia, and highlighted the cultural and language gap between that of the working class students and the middle class school they attended.

Even though Appalachia is sparsely represented in educational research, including that dealing with poverty, almost no studies have addressed the Appalachian culture in relation to learning mathematics. In fact, so little research in mathematics education focuses on rural issues, the editor of the *Journal for Research in Mathematics Education* declared that mathematics education researchers suffer from "an attention deficit disorder with respect to rural education concerns" (Silver, 2003, p. 3).

> In recent decades, many studies have focused on urban students, teachers, and schools and far fewer have considered their rural counterparts. To the extent that there are issues of specific concern to the students, teachers, and schools in rural communities – issues that are not adequately *covered* by research that addresses broader topics, including equity – it appears that they are grossly underrepresented in our research literature. (p. 3)

Harmon, Henderson, and Royster (2003) acknowledged the inadequate research base in rural mathematics education and set forth *A Research Agenda for Improving Science and Mathematics in Rural Schools* in response to federal legislation mandating "scientifically-based" policies and practices. Howley (2002) noted that quantitative studies "are far less likely to unfold without an informative base of qualitative studies that articulate rural meanings in the context of mathematics knowledge at work – in and out of rural schools" (p. 20).

*Sociocultural Theory and Situated Learning*

The study of mathematics learning within the culture of Appalachia is aided by the sociocultural theory of learning, an underlying precept to the current mathematics reform (Ball & Bass, 2000; Forman, 2003). In this theory, individual learning takes place within a community of practice and the role of language is paramount to understanding (Nickson, 1992; Zevenbergen, 2000). A sociocultural view aids in understanding that home practices and language register may connect with or conflict with school practices and language register (Forman, 2003; Payne, 2001). Determining ways in which the Appalachian culture impacts the learning of mathematics

and meanings derived from mathematical instruction can be explored through conversation and narrative.

Lave (1998) placed cognition in a social setting in her study of mathematical problem solving using real world opportunities. Through the Adult Math Project she sought to identify everyday mathematics practices and how they related or did not relate to academic mathematics using dual frameworks in cognition and anthropology. "Mathematizing objects and situations in every day activity" helps the individual to perform a mathematical task in a real world situation (Nune, 1992, p. 572). Juxtaposing non-academic mathematics needs with school based mathematics instruction can help to explain a lack of understanding of school based tasks. Investigating mathematics learning within the culture of Appalachia can reveal ways in which these students learn or fail to learn the mathematics needed for future goals.

Atweh, Bleicher, and Cooper (1998) investigated the context of two mathematics classrooms, one with male students of high socioeconomic status [SES] and one with female students of low SES, and analyzed the factors affecting classroom discourse. Though they did not attempt to isolate the effects of gender and socioeconomic status, they determined that each teacher's perceptions of their students determined how the teachers conducted their classes; the teacher of the high SES males taught them as future college students, and the teacher of the low SES females taught them as "potential consumers" (p. 80). Their primary concern was that "the constructed communication in the classroom reinforces the development of the human subject in a certain image" (p. 80). "Thus classroom interactions, being consistent with teacher perceptions, tend to have a self-fulfilling role for teacher expectations" (p. 80). In their study, the teacher-student interaction impacted the type of mathematics content learned. An exploration of teacher-student interactions within the context of Appalachia may help to determine, for example, how negative stereotypes and elements of the Appalachian culture influence mathematics learning.

*The Problem in Context*

As a former middle school mathematics teacher, I was enlisted at the college where I teach to tutor students who failed to make the minimum score on the *Praxis I* – Mathematics[5] test. The students I worked with were eager to learn, and I wondered why they had not learned the mathematics that seemed to be what I had taught in the seventh and eighth grade. So I questioned them about their mathematics experiences in public school. As a result, I began to question how they could have learned the mathematics so differently that it did not match what was tested on the *Praxis I* and if it could be related to attending school in Appalachia. These students eagerly talked about their experiences, and I learned what impressed them in their classes, what made them uncomfortable, what gave them confidence, and how they felt about themselves as doers of mathematics. I thought that if I had had this knowledge when I was teaching, I would be a more effective teacher. Therefore, I felt it important that their stories be shared in order to describe mathematics and school experiences within the context of Appalachia. Their accounts could afford teachers of mathematics and scholars a new perspective on how students learn mathematics. In addition, as future teachers of mathematics for

[5] *Praxis I*, also known as the *Pre-Professional Skills Test*, is published by the Educational Testing Service [ETS] and consists of three multiple-choice tests: Mathematics, Reading, and Writing. A minimum score on each test was one of the requirements for initial teacher licensure in Virginia beginning in 1996. (Virginia Department of Education, 2004).

elementary children, they could become aware of how teaching practices, especially in mathematics, influence students and their learning.

*Purpose and Research Questions*

The purpose of this research is to explore the mathematical backgrounds of current and future elementary teachers who have grown up in Central Appalachia, an area of rural poverty. My research questions are:

- What are the life stories of pre-service and in-service elementary teachers from Central Appalachia, and how do they view their experiences in learning mathematics?
- How did aspects of the Appalachian culture influence the participants' view of their own learning and their images of themselves as capable in mathematics?

*Rationale for This Study*

Given the contextual emphases of the research questions, the framework based upon sociocultural theory and the virtual silence of the literature on mathematics education in the rural poverty of Central Appalachia, an ethnographic case study method is most appropriate. Through participant interviews, examination of artifacts, additional communications, and researcher notes, life histories with an emphasis on the learning of mathematics within the culture of Central Appalachia were constructed and verified by the participants. Their life histories informed the research question, revealing links to broader issues and ideas (Ritchie, 2003), as observations of unusual findings or cross-case similarities may become the basis for further research.

*Assumptions*

As a native Appalachian who taught public school for sixteen years in a poor rural county in Appalachia, my assumptions are based on those unique life experiences and may differ from my colleagues in other geographical areas with differing cultural affiliations.

- Appalachia is a geographical region, as well as a culture, that may differ from one sub-region to another. The cultural distinctions are influenced by socioeconomic level, race, and degree of rurality of the region.
- The derogatory images of the people who live in the Appalachian region are misleading and damaging and are pervasive within and outside of the region.
- Students from poor rural schools face a variety of challenges, some unique, to learning, but do not have inherent deficits in mathematical ability.
- Culture impacts learning in obvious and hidden ways. Making the aspects of culture explicit helps to identify ways in which we make meaning of experiences.

# Chapter Two

## Review of Literature

Ladson-Billings (2004) included in her chapter summary for the *Handbook of Research on Multicultural Education* recommendations for scholars and teachers:

> In K-12 classrooms, teachers will have to work back and forth between individual and group identities, while at the same moment taking principled stands on behalf of students who, because of some perceived difference or sense of otherness, are left behind. The new work of multicultural education must be more generative. Both scholars and classroom teachers must look for opportunities, new ways to think and learn about human diversity and social justice. (p. 63)

Although Appalachians, as a cultural group, are not mentioned in the *Handbook of Research on Multicultural Education* (J. A. Banks & C. A. M. Banks, 2004), Appalachian students also bear a sense of "otherness", are behind academically, and are in need of social justice. In hopes of adding to the meager research base on learning in Appalachia, my study is based on the sociocultural theory of learning in regards to mathematics which embraces the notion that culture and context impact learning both cognitively and affectively. Studies of other multi-cultural groups shed light on cultural aspects which may contribute to or detract from learning mathematics. Then an examination of literature on Appalachian culture revealed differences from the mainstream which impact learning. Because Appalachia is also identified as an area of rural poverty, the little that is known about learning mathematics in areas of poverty, especially rural poverty, contributed to the understanding of the Appalachian culture as well.

### *Sociocultural Theory in Learning Mathematics*

Sociocultural theory has its origins with Vygotsky whose theories placed cognition within relationships (Gergen, 1999) and included such constructs as the Zone of Proximal Development [ZPD], an area of learning where an individual can progress only with the help of a more experienced other (Bransford, Brown, & Cocking, 2000; Taylor, 1992). Later theorists, such as Bruner, expanded upon Vygotsky's initial ideas of the cultural tools, such as language and symbols which are used to gain and transmit knowledge by incorporating narrative to understand human thinking and experience (Bruner, 1986). Utilizing the sociocultural idea of funds of knowledge[6] in literacy studies of minority and working class children, Moll explored the cultural unit of the family, as well as the community, in order to impact pedagogy (Gonazlez, Andrade, Civil, Moll, 2001; Moll, 1997; Moll, Amanit, Neff & Gonzalez, 1992; Moll & Arnot-Hopffer, 2005).

Writing in *A Research Companion to Principles and Standards for School Mathematics* (2003), Forman first described contemporary sociocultural theory as "the institutional context of goal-directed activity (in schools, homes, community centers, libraries, etc.)…within communities of practice…mediated by a variety of speech genres" (p. 336). She also emphasized the role of relationships and communities of practice:

> Teaching and learning activities are typically carried out over time by people who are familiar with one another, who develop particular kinds of relationships, and whose

[6] Funds of knowledge refers to "bodies of knowledge that underlie household activities" (Moll, 1997, p. 191).

> interactions involve complex motives, beliefs, norms, goals, and values. … models that describe individuals' and groups' goal-directed activities as constituting and constituted by institutionally, culturally, and historically situated communities of practice. (p. 336)

Although the *Handbook of Research on Mathematics Teaching and Learning* (Grouws, 1992) did not contain a separate chapter on socio-cultural theory, references to social context and culture are found throughout. For example, Good, Mulryan and McCaslin (1992), building upon Vygotsky's theories to investigate small group dynamics in mathematics, recognized "the individual is a product of personal social experiences" (p. 174). Nickson (1992) examined the culture of the mathematics classroom, "the invisible and apparently shared meanings that teachers and pupils bring to the mathematics classroom and that govern their interaction in it" (p. 102.) Nunes (1992) explored ethnomathematics[7] to discuss cultural bases in elementary mathematics topics and to generalize theory regarding cultural conventions, social aspects of language, and metacognition. Gonzalez, Andrade, Civil, and Moll (2001) found that integrating mathematical funds of knowledge from the home context to the school context was less straightforward than identifying literacy connections, requiring "not only the store of funds of knowledge, but the transformation of that knowledge into meaningful activity" (p. 130).

Referring to art education, but with a tie to mathematics education in terms of promoting higher order thinking and presenting challenging problems, Fielding (1989) describes one of the major tenets of sociocultural theory; "the modes of thinking, reasoning, and problem solving acquired by the child are derived from cultural norms as transmitted by social agents such as adults" (p. 46). Culture and context are also emphasized in *How Students Learn* (Donovan & Bransford, 2005), a project of the National Research Council. That framework uses four lenses with which to describe student learning: Learner, Knowledge, Assessment, and Community, two of which specifically recognize the importance of culture in learning.

> Finally, students' expectations regarding their own performances, including what it means to be intelligent, can differ in ways that affect their persistence in and engagement with learning. Being learning-centered then, involves paying attention to students' background and cultural values, as well as to their abilities. (p. 14)
>
> Learning is influenced in fundamental ways by the context in which it takes place. Every community, including classrooms and school, operates with a set of norms, a culture - explicit or implicit – that influences interactions among individuals. This culture, in turn, mediates learning. (p. 20).

Socio-cultural researchers acknowledge the many facets of our world which contribute to a child's education:

> Funds of knowledge that children bring to the classroom, to resistance among learners who are marginalized, to children's development of concepts that reflect their families and their own daily experiences, to the importance of dialogue between learners, teachers, and texts, and to the multiplicity of semiotic means and the diversity of

[7] Ethnomathematics, a term coined by Brazilian researcher, Ubiratan D'Ambrosio, are "the different mathematics which occur in specific natural and cultural environments" (D'Ambrosio, 2002, p. 2). D'Ambrosio views mathematics education as a means to "restore cultural dignity of children" (p. 2) and "to be prepared for full participation in society" (p. 3) in the interest of promoting equity and peace.

> teaching/learning contexts both within and outside of schools. (John-Stiener & Mahn, 2003, p. 147)

Thus, socio-cultural theory provides a way of understanding the impact of culture on learning.

*Mathematics Multicultural Education*

In a sense, multicultural education can be viewed as sociocultural theory put into practice. Describing and defining multicultural education, J. A. Banks (2004) presented four dimensions: content integration, knowledge construction, prejudice reduction, and equity pedagogy. Content integration is primarily what is shown and taught, while the knowledge construction process helps "students to understand how knowledge is created and how it is influenced by the racial, ethnic, and social class positions of individuals and groups" (p. 4). Prejudice reduction "describes the characteristics of children's racial attitudes and suggests strategies that can be used to help students develop more democratic attitudes and values" (p. 5). Teachers using equity pedagogy promote academic achievement for students who are members of diverse and marginalized groups by their classroom decisions and teaching strategies.

Prior to discussing her study of the influence of a multicultural professional development program on mathematics teachers, Sleeter (1997) suggested four themes from the literature on mathematics and multicultural education. The first centered on using pedagogy to help students from lower-achieving groups succeed in mathematics, and the second relates to the first by creating higher expectations in mathematics for those groups. The next was the promotion of mathematics as a "culturally pluralistic curriculum that helps all students see mathematics as a creation of people like themselves" (p. 682). The last theme centered on connecting mathematics to social issues in students' lives (Sleeter). Teaching mathematics in a culturally responsive manner emphasizes a respect for the students' culture, exploits the strengths and capabilities of that culture, and holds high standards for students from all cultures (Malloy, 1997).

African American students, for example, often have white teachers who fail to connect on a personal level with them, and a caring relationship with the teacher is especially important to African American students, according to Walker and McCoy (1997). Without it, African American students may sit in silence in the mathematics classroom, demonstrating a reluctance to elaborate on answers or ask for help (Walker & McCoy). To describe other learning preferences of African American students in mathematics, Malloy (1997) cited studies showing that this group of students solves problems in a field dependent manner, holistically and with creativity, using language or motor skills. She also found that community interdependence and social learning to be important aspects of learning mathematics. Lee and Slaughter-Defoe (2004) described three academic programs that have been successful with African American students. One, the Algebra Project, "draws on culturally specific norms by consciously encouraging students to express a descriptive representation of an algebra problems using…whatever the indigenous language of the student may be" (p. 476). The Math Workshop at the University of California at Berkeley stressed shared knowledge and working together cooperatively to match the "African American values of group cooperation and social responsibility" (p. 476).

Khisty (1997) emphasized the role of language in teaching mathematics to Latino students. "One defining characteristic of Latino students is their strong affinity to Spanish irrespective of their ability with the language" (p. 93). She stressed that the teacher is a role model for language acquisition and for taking measures to see that Latinos are not at a disadvantage in group work due to their language or social status. Because those immigrant

students who hold a bicultural identity tend to fare better academically, and because negative stereotypes of Latino youths abound, teachers and schools must value and promote cultural understanding. (Suarez–Orozco, Suarez–Orozco, & Doucet, 2004). Even though Latino parents high have aspirations for their children, they may come from "traditions that revere school authorities and expect parents to keep a distance from the day-to-day workings of their child's education" (p. 431). School personnel should not assume that this reflects a lack of interest.

Gutstein, Lipman, Hernandez, and de los Reyes (1997) investigated culturally relevant teaching of mathematics in a Mexican immigrant community. They observed that, in general, teachers do not automatically connect multicultural education to teaching mathematics because "mathematics is usually seen as a neutral and objective subject devoid of specific class, cultural, or political content" (p. 731). In addition, "even when mathematics learning is seen as personally empowering, it is rarely though of as having broader, social justice implications for those learning it" (p. 731). However, the teachers in their study demonstrated connections between teaching mathematics and social justice in a variety of ways, primarily building upon students' cultural knowledge and providing them with the knowledge and skills to prepare them for future leadership roles.

Culturally relevant mathematics lessons incorporating Pueblo Indian culture have been successfully implanted by Taylor (1997) with students of various ages. These include building a three-dimensional scale model of the Taos Pueblo in New Mexico, integrating mathematics and literature centering on American Indian topics and authors, and using designs from American Indian artwork to explore geometric concepts. In addition to the content, Taylor stressed the noncompetitive and cooperative aspects of the projects which work well with American Indian students and with non-Indian students. Lomawima (2004) discussed the right of self-determination of education for Native Americans and other trends in Native American schooling such as linguistic performance, group cooperation, field-dependency and field-independency, and other learning and interactional styles.

The three ethnic groups mentioned here, African Americans, Latinos, and Native Americans, learn mathematics in different ways among and within their groups. But all suffer disproportionately in common social problems, such as poverty and prejudice, which negatively impact their educational opportunities (J. A. Banks & C. A. M. Banks, 2004). Another group within the achievement gap in mathematics is from the Appalachian region, particularly Central Appalachia for which little research exists regarding how students learn mathematics in that culture (Bush, 2003). Recognition of the different ways in which mathematical learning takes place within other marginalized groups will inform the investigation into how aspects of the Appalachian culture impact the learning of mathematics.

*Appalachian Culture in Education*

Few studies of education in poor rural areas have been published, so the literature store on education in Appalachian is not well-stocked. The research on Appalachian schooling in the decade after President Johnson declared War on Poverty portrayed the students as culturally deprived, the parents as apathetic, and the schools as perpetuators of mainstream values from the dominant society to the detriment of the culture of the rural Appalachian folk (Mielke, 1976). Some argue that Appalachia, due to the racial makeup of primarily White Anglo-Saxon individuals, is neither a culture nor a subculture. Keefe, U. M. L. Reck, and G. G. Reck (1983), however, reviewed the nature of ethnicity among Appalachians. Within a structural, cultural, and

symbolic framework[8], Appalachia appears to have a distinct ethnicity but with many overlaps of "ethnic group membership, socioeconomic class, and rural residence in the region" (p. 218); a conclusive finding is not possible without further research.

Keefe et al. (1983) noted differences between Appalachians and mainstream America in terms of "ties to their homeland (the mountains), familism, a unique history, a Southern Mountain dialect, fundamentalist religions, and various value orientations" (p. 203). The differences were particularly acute in terms of education, and they attributed the low levels of educational achievement to schools that promote social stratification and "ignore mountain culture, imposing the dominant cultures' values" (p. 208); indigenous teachers did not promote or even recognize the Appalachian culture. Other external factors included low socioeconomic status, the rural life patterns, strong family ties, and parental influence. Internal factors contributing to low achievement were students' perceptions of discrimination, teacher impact, and institutional discrimination.

In 1980, U. M. L. Reck compared rural Appalachian and urban non-Appalachian sixth-graders in a quantitative study on self-concept. She found that "school-related notions of the self, either explicitly stated or implied, were the single most important area contributing to the more negative self –concept of the rural Appalachian children" (p. 52). Exploring the underlying factors for this finding, U. M. L. Reck and G. G. Reck (1980) discussed the reactions, alienation and hostility, of the parents and community to the school. "Added to this feeling that education has been of questionable value is the feeling that school consolidation has placed undue hardships on rural residents" (p. 22). The difficulties were of a physical nature, involving longer bus rides, and attitudinal in that parents were reluctant to talk with the teachers who treated them condescendingly. In short, schools are "external institutions which do not serve the real needs of rural Appalachian people" (p. 22). In a study of cultural resistance in Appalachian schools, Woodrum (2004) found "Poor Appalachian families (6 of 7 fourth-grade parents, and 7 of 8 ninth grade parents), however, frequently see in the loss of the local schools further evidence of their own social and economic dispossession" (p. 8).

Keefe, G, G. Reck, and U. M. L. Reck (1989) began a research project in a region of Appalachia in North Carolina that had a burgeoning tourist/recreation industry and an influx of more-affluent non-Appalachians causing an obvious economic discrepancy between the two groups. In an effort to understand ethnicity in relation to lower academic achievement of the Appalachians, they devised a survey instrument for students at the consolidated high school reflecting the dimensions of ethnicity: structural, cultural, and symbolic. The administrators of the high school approved of the survey and cooperated with the researchers. Nevertheless, the survey outraged many of the students and teachers; many refused to complete it or took it home to their families. " 'I think you are making all of us look like hillbillies' " (p. 30) wrote one student; others wrote that they were not prejudiced like the researchers. The controversy appeared in the newspaper and on radio. The researchers apologized by writing a letter to all the high school students and offered to give the school administrators the data and to do staff development, but they declined. They concluded that there existed a dichotomy with educators who denied the mountain culture of the students, yet blamed it for their academic failures. The data from the surveys and unexpected aftermath led to further conclusions:

[8] The structural approach focuses on conflict and the competition for scarce resources as a basis for ethnicity" (Keefe, U. M. L. Reck, & G. G. Reck, 1983, p. 200). "The cultural approach…is a standard ethnographic approach which identifies a body of material culture, behaviour, customs, and values shared by the group" (p. 201). In "the symbolic approach,…the emphasis is on an emotional attachment to a group, a sense of 'peoplehood" (p. 201).

> As a result, native Appalachian students on the whole have low self-esteem, become ambivalent about their cultural heritage, experience an inadequate education, and often blame themselves individually for their lack of educational success rather than conclude that Appalachians as a group are treated unequally. (p. 34)

U. M. Reck, G. G. Reck, and Keefe (1993) continued their studies of "ethnicity, socioeconomic class, and rural/urban residence as factors affecting the school experience of Appalachian students" (p. 117) by interviewing teachers in the same Appalachian county to see if they made distinctions between Appalachian students whose families had lived in the mountains for at least three generations and non-Appalachian students, born outside of the region, whose families had moved there to work in primarily white collar jobs. Their findings showed that both the Appalachian-born and non-Appalachian teachers viewed the Appalachian students as rural or "rednecks" with descriptions matching the stereotypes. As one non-Appalachian teacher stated, "They are the county students who are in the lower tracks. They chew tobacco, have long greasy hair, are not clean and smell, use bad grammar and profanity, and their dress is not acceptable" (p. 119). The non-Appalachian students, called the "town kids," were most often complimented by teachers; "Town kids have more social skills, are more confident, are more involved in school activities, and do better academically" (p. 120). While the researchers determined the Appalachian ethnicity to be primarily symbolic and structural, with cultural distinctions such as identity and family/social relationships, "most of the differences were found to be SES-linked" (p. 120). Yet the teachers attributed these differences primarily to Appalachian ethnicity. As a result, "In this case teachers' perceptions both reflect and reinforce the system of dominance hierarchy which shapes the inequitable educational experience in Appalachia" (p. 121).

As a participant-observer, DeYoung (2002) studied Appalachian schools in one West Virginia County with a different framework, de-emphasizing ethnicity and viewing the schools' problems as relating to their isolated, rural nature. "My fieldwork also underscores the efforts of local educators to compel students to use their education as a cultural bridge from central West Virginia to the national culture" (p. 172). In the schools, teachers and principals viewed themselves in a compensatory education role to offset the poverty and disadvantage of the students; efforts ranged from collecting winter clothes to taking students on field trips to movies, shopping malls, and fast food restaurants. Few parents were active in the academics of the school, but sports booster organizations were well attended. The schools were held accountable for student achievement, so few cultural activities were provided. Although the school system was the largest employer in the county, it did not seem to house the patronage and nepotism that the surrounding counties were noted for. Students often did not see the value of a high school education when "physical work remains more often understood as real work, while book learning an academic pursuits are less frequently valued as suitable for able-bodied boys" (p.177). Male students' interest in firearms, all-terrain vehicles, and pick up trucks were somewhat encouraged by the school calendar; no classes were held during the first week of hunting season. DeYoung did not mention the recreational activities of girls, however a sense of place was strong for both genders:

> Youngsters are not sure under what circumstances they want to leave and how far they may be willing to go. Many prefer to live close to the place of their birth and to their

> families, and allegedly would prefer to live on some sort of government assistance instead of looking for work that is uncertain. (p.177)

Schools in this county were under considerable pressure to meet state accountably standards in spite of the poverty and cultural obstacles. Therefore the school teachers and administrators saw themselves as preparing students to be successful in life outside of the region (DeYoung).

*Appalachia and Rural Poverty*

Intertwined with the culture of Appalachia are the rural isolation of the region and the stigma of poverty. Oftentimes, just the term "rural" is automatically assumed to be rural poverty. And while all rural areas are not economically disadvantaged, "244 of the 250 poorest counties in America are rural" (Mathis, 2003, p. 2). The term Appalachia is also considered to be synonymous with rural poverty, although it reaches from northern Alabama and Georgia to southern New York, and is as inwardly diverse as it is different from mainstream America. Perhaps the most stereotypical notion of Appalachia resides in what the Appalachian Regional Commission [ARC] refers to as Central Appalachia, consisting of contiguous counties in Kentucky, Virginia, West Virginia, and Tennessee that share characteristics of topology, demographics, and economics (Appalachian Regional Commission, 2003.)

*Findings on Mathematics Achievement in Rural Areas from NAEP*

Achievement scores in mathematics on the National Assessment of Educational Progress [NAEP] in 1996 and 2000 showed that the averages nationwide of rural students in comparison to non-rural students were nearly the same and that "a national rural versus nonrural mathematics achievement gap does not exist" (Howley, 2003, p. 3). Great variations in achievement were present at the state level, however, suggesting non-random conditions such as gaps in educational structures, culture, equity, adequacy, personnel, and purpose at the local levels could negatively impact achievement (Howley). Yet the low achievement levels were not identified with any certain geographical area.

In an effort to discover connections between school practices and mathematics achievement, Bottoms and Carpenter (2003) focused on NAEP and survey data from rural schools in seven southern states. The 8$^{th}$ grade and 12$^{th}$ grade mean scores were at the lower range of the Basic Level out of three levels: Basic, Proficient, and Advanced, even though many low achieving students drop out before the 12$^{th}$ grade. As a result,

> many students enter high school unprepared for a rigorous college-preparatory mathematics curriculum…many students graduate from high school without the mathematical skills and knowledge needed to successfully compete for the "good jobs" in today's economy or to enter postsecondary programs of study without remediation in mathematics. (p. 2)

The poor mathematics achievement scores in 8$^{th}$ and 12$^{th}$ grades for those seven southern states were connected to factors determined from the survey question data: lower level course taking patterns along with few opportunities for extra support, low teacher expectations, infrequency of numeracy experiences across the curriculum, and lack of guidance and advisement (Bottoms & Carpenter).

Bush (2003) focused the NAEP lens more narrowly noting that "Eighth-grade students in all three states [in Central Appalachia] scored below the national average. Furthermore, students in Appalachian areas of these states scored at lower levels than other students in other regions of the states" (p. 11). He discussed factors affecting student achievement which included the difficulty of attracting and retaining qualified teachers in rural areas, pedagogy involving low expectations and traditional methods, lack of mathematics education specialists in higher education, and a culture which places less value on national goals and more on local communities and family ties. To promote "*indigenous leadership capacity* for the improvement of school mathematics in rural places" is a goal of The Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics [ACCLAIM], "funded in 2001 by the National Science Foundation [NSF] as one of 10 Centers for Learning and Teaching nationally" (p. 16).

*Appalachian Collaborative Center for Learning Assessment and Instruction in Mathematics*

The Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) is showing promise for focusing long-overdue emphasis on mathematics achievement in Central Appalachia and for "providing a model and resources for other isolated, rural, poverty-stricken areas across the country" (ACCLAIM, 2004b, ¶1).

> The two primary goals of ACCLAIM in these Appalachian regions are to (1) build mathematics capacity and expertise through advanced degree programs in mathematics, job-embedded professional development for middle and high school mathematics, and research that connects mathematics and rural education, and (2) improve the quality of mathematics teacher education programs and mathematics teaching at the middle and high school levels in these Appalachian regions through the development of collaborative networks and innovative delivery systems. (¶2).

With partners from universities in and around the region, ACCLAIM hopes to impact the quality of instruction and ultimately narrow the achievement gap in mathematics.

In preparing the research agenda, the ACCLAIM leadership team sought out researchers from mathematics education as well as rural education to determine the current state. They concluded:

> Research that focused on mathematics education in rural contexts is limited, with just 23 studies published in the journal literature between 1990 and 2001. No studies focused on the larger issue of mathematics as it situates itself in rural communities. A research agenda that focused on mathematics education issues in rural settings, particularly localized rural settings, has much to offer educators, policy makers, and rural communities. (ACCLAIM, 2004a, ¶2).

Gathering, conducting, and disseminating research that addresses the educational problems in Central Appalachia may be an all-important initial step in improving the plight of students who live there.

*Mathematics Achievement of Students in Areas of Poverty*

Nearly 40 years after President Lyndon Johnson declared War on Poverty, the battles continue while children suffer the greatest causalities. Currently, more than 1/6 of all those under the age of 18 in the United States live in poverty, defined by the United States Department of Health and Human Services [USDHH] as a family of four having an annual income of $18,400 or less (2003). As the most vulnerable victims, children also represent a disproportionate segment of the total poor population, 35.7% (Procter & Dalaker, 2002). Poverty arises from and results in a variety of economic, cultural, health, and social problems, not the least of which is educational achievement, particularly in mathematics (Secada, 1992; Waldfogel, 2001).

Secada (1992) noted, "Achievement disparities based on social class and racial/ethnic group membership can be detected almost as soon as students can be reliably tested. They are pervasive, evident across mathematical content domains and skill levels, and increasing over time" (p. 639). According to a 1998 Title I Report, "The average math achievement for 9-year-olds in high-poverty schools still falls more than two grade levels behind performance in low-poverty schools" (U.S. Department of Education,1998, p.1). In 2000, students in grades four, eight, and twelve who were eligible for the federal Free/Reduced-Price Lunch Program had lower scores on the *National Assessment of Educational Progress* [NAEP] in Mathematics than those who were not eligible (Barton, 2002; Braswell, Lutkus, Grigg, Sanapau, & Johnson, 2001). At every grade level, students in poverty face the greatest challenge when it comes to learning and achieving in mathematics, yet the school's socioeconomic level appears to even more closely predict mathematics achievement than individual poverty levels (Secada, 1991).

*Federal Government Programs*

The federal government, granted neither power over public education nor barred from it by the U.S. Constitution, was mostly uninvolved until the decade of 1950 when two events opened the door. The U.S. Supreme Court ruled segregated schools unconstitutional in 1954 with *Brown v. Board of Education*, and civil rights, especially in education, gained national awareness. Then a human-made satellite, Sputnik, was launched by the Russians on October 4, 1957, causing grave concerns about the quality of public education, particularly in mathematics and science. Congress responded with The *National Defense Education Act* creating the National Science Foundation and providing financial support for science, mathematics, foreign languages, and technology (Hunt, 2002; Mitchell 2000; Spring, 2002). Eventually the spotlight on poverty, which began with President John F. Kennedy's inaugural address, entered federal legislation in 1965 as President Lyndon B. Johnson signed the Elementary and Secondary Education Act (ESEA) into law (Mitchell; Ribich, 1968).

Based on the number of students living in poverty, ESEA provided funds to states for use at primarily their discretion; Title I was the most heavily funded, providing money for instructional materials, extra services, training, and additional personnel to work with disadvantaged children. ESEA initiated the idea of compensatory education which labeled the poor as educationally disadvantaged and culturally deprived, perpetuating a "blame the victim" attitude (Levin, 1977). The "culture of poverty" was described by Lewis (1969) as "both an adaptation and a reaction of the poor to their marginal position in a class-stratified, highly individuated, capitalistic society…[and] an effort to cope with feelings of hopelessness and despair" (p. 188). Despite the modest gains made by students in poverty after the advent of ESEA, the achievement gap remained. The students served by Title I had shown greater gains than those without service, and more gains in mathematics than in reading. As stricter

accountability measures were put in place, the Title I programs became somewhat more efficient in preventing some of the cumulative educational effects of poverty for students (Mitchell, 2000).

Federal aid for education was cut drastically in the 1970's, but ESEA was reauthorized in 1988, increasing focus on academic achievement of disadvantaged children, although the mathematics instruction continued to focus on basic skills, rather than higher order thinking (Mitchell, 2000; Zucker, 1991). Goals 2000, the 1994 *Educate America* Act signed into law by President Bill Clinton, contained firmly stated goals that were to be accomplished by the year 2000, such as all children ready to learn when they enter school and American students first in the world in mathematics and science. Rather than singling out disadvantaged students for this program of voluntary state compliance, the focus was to encourage achievement for all students. The bill included an opportunity-to-learn [OTL] standard, requiring schools to create equitable learning conditions in order to receive the federal dollars; but due to the controversy this standard created, it was removed in 1993 (Mitchell, 2000). ESEA was reauthorized again, also in 1994, with curriculum and instruction for Title I schools tied to assessments used for all children, and a more liberal definition of a Title I school, 50% of the student body in poverty instead of 65%. Title I schools received more funding to benefit the whole student body (Mitchell). As for Goals 2000, it is no longer a viable program. According to the website, The National Education Goals Panel, "an independent executive branch agency of the federal government charged with monitoring national and state progress toward the National Education Goals…has been dissolved pursuant to Congressional mandate" (National Education Goals, 2002).

The 2001 *No Child Left Behind* [NCLB] Act, signed by President George W. Bush, is yet another reauthorization of ESEA with renewed, but redistributed, funding and emphasis on correcting the achievement gap in reading and mathematics through accountability, standards, and high quality teachers (U.S. Department of Education, 2001). With its emphasis on standardized test scores, and school and state report cards, combined with inherent disparities in school demographics, funding questions, and penalties for failure to meet the standards, it has met with criticism from teachers and administrators. The effectiveness of this latest government effort at addressing the achievement gap in mathematics for low SES students is under scrutiny by the public and the education community, but comprehensive assessment of such a pervasive educational program awaits retrospective comparisons in the future.

*Exemplary Programs*

While the federal government attempted to address the inadequate mathematics achievement of students in poverty with legislation and funding, other programs addressing the problem have been successful on a smaller scale, at times originating with one person. Such is the case with Robert Moses, a math teacher, civil rights activist, and founder of the *Algebra Project* who sought to increase the access to higher mathematics, and subsequently to higher education, of disadvantaged Black children (Schoenfeld, 2002). His successful program involved teaching algebra to middle school children by a concrete-to-abstract continuum and relating it to the students' contexts with an effort to involve parents and the community (Moses, Kamii, Swap, & Howard, 1989). According to the website, "The Algebra Project is now being implemented at 22 sites in 13 states across the South, the West Coast, the Midwest and the Northeast. Many sites are set up in both urban and rural areas to work especially with traditionally under-resourced communities of color" ("The Algebra Project," n.d., p.1).

Portrayed in the 1988 movie, *Stand and Deliver*, Jaime Escalante taught mathematics to poor students at Garfield High School in East Los Angeles. After years of building a mathematics program, his disadvantaged students began to take and succeed in calculus in unexpectedly large numbers. In 1982 when so many of his students passed the Advanced Placement Exam, the Educational Testing Service [ETS] suspected cheating and asked them to retake the test. Almost everyone passed it the second time, confounding his critics. He has since retired, but as the host of *Futures*, an instructional television series showing authentic mathematics and science applications in career situations and still available from Public Broadcasting, his influence continued (National Teachers Hall of Fame, 2000).

Specifically targeting the "least well served by the current educational system: racial and ethnic minorities and the economically disadvantaged" (Silver, Smith, & Nelson, 1995, p. 9), Project QUASAR [Quantitative Understanding: Amplifying Student Achievement and Reasoning] was launched in 1989 as a "practical school demonstration project….and a complex research study of educational change and improvement" (p. 12). The purpose of the QUASAR program, working within schools in poor communities across six states from Pennsylvania to California, was to improve the "accessibility, quality, and relevance of middle school mathematics instruction" (p. 26). QUASAR was not a "one size fits all" project but placed instruction based on research in learning and incorporating tenets of the mathematics reform squarely in the community context.

A wide variety of programs have focused on equity in mathematics achievement by improving curriculum and instruction for all, "a rising sea raises all boats" philosophy. Others have concentrated on the achievement gap by targeting specific minority groups, such as African American, Hispanic, non-English speaking, or female students, for specific mathematics instruction. Other lenses from which to view and address the mathematics achievement gap included students in urban and rural locations and students who were struggling or low achieving in mathematics. Taken all together, considerable efforts have been put forth to achieve equity in mathematics instruction, and therefore, comparable mathematics achievement. But not until recently has the mathematics education community looked at programs and policies specifically targeting low socioeconomic status [SES] students.

*Poverty Issues in Mathematics Education Research*

Given the longevity and pervasiveness of poverty's connection to lower educational achievement in mathematics, one would expect it to be extensively addressed in the literature, perhaps under the guise of low SES or class. Lubienski and Bowen (2000) counted and categorized more than 3,000 articles in mathematics education research, published from 1982 through 1998. They examined the equity categories of ethnicity, gender, social class, and disability, and, of the four, found only gender well represented.

> Not only were the actual numbers low [for class and ethnicity], but also there were particular topics that seemed strangely lacking in attention: (a) links between social class and early childhood (e.g., Head Start) or adult basic education and (b) the special strengths and needs ethnic or class groups have in relation to various topics, such as statistics, algebra, and calculus (which often serve as gatekeepers). (p. 631)

In most articles on ethnicity or class, the researchers studied the dependent variable of student achievement without examining the effects of teachers, the school environment and other

influences. “One gets the impression that researchers look primarily at outcomes of these equity groups and rarely examine how schooling experiences contribute to these outcomes (Lubienski & Bowen, p. 631). Almost 10 years earlier, Zucker (1991) had come to the same conclusion; “relatively little has been done to zero in on the particular needs, circumstances, or proper instruction of disadvantaged students” (p. 189).

Current literature largely takes the form of examining the data on poverty and achievement or defining the risk factors inherent in low-SES students. Some of these studies may be included as part of a larger study of race, ethnicity, and gender issues. Tate (1997) examined standardized test data such as college examinations and Advanced Placement tests and trend data from NAEP and the National Education Longitudinal Study of 1988 [NELS:88] to determine changes in mathematics achievement for race-ethnicity, SES, gender, and language proficiency groups. He found poverty to be among African American and Hispanic students in greater percentages than among whites and that SES is strongly connected to mathematics across the assessments. “These test results demonstrate the need to raise the mathematics achievement of low-SES students as a whole and, even more urgently, of low SES-minority students” (Tate, p. 667). He also stressed that interventions were urgently needed in urban and rural communities, the two geographic areas with the highest poverty levels. Clearly a need exists for rectifying the mathematics achievement gap between the poor students and their more affluent counterparts. One would expect the direction for such a challenge to originate with the National Council of Teachers of Mathematics.

*Poverty Issues Addressed in NCTM Publications*

The National Council of Teachers of Mathematics [NCTM] briefly addressed the equity issue for gender and ethnicity in the revolutionary *Curriculum and Evaluation Standards for School Mathematics* (1989) under “Opportunity for All”:

> The social injustices of past schooling practices can no longer be tolerated….Mathematics has become a critical filter for employment and full participation in our society. We cannot afford to have the majority of our population mathematically illiterate. Equity has become an economic necessity (p. 4).

However, Secada (1991) noted that the subject of equity was conspicuously absent from the draft *Curriculum Standards*, but after feedback from the NCTM membership, it was included. The 1991 *Professional Standards for Teaching Mathematics* (NCTM) stated in Standard 3 for Professional Development that practicing and preservice teachers should become knowledgeable about “the influences of students’ linguistic, ethnic, racial, and socioeconomic backgrounds and gender on learning mathematics” (p. 144). No information was given about the possible influences of either socioeconomic backgrounds or their effects on classroom practices. Slightly more emphasis, however, was evident in the revised NCTM *Standards* published almost a decade later.

Equity is the first of six principles described, in the *Principles and Standards for School Mathematics* (NCTM, 2000), as “a core element of this vision. All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have the opportunities to study – and support to learn – mathematics” (p. 12). The Equity Principle mentions different demographic groups, noting students of poverty specifically only once, as probable victims of low expectations. The terms poverty, low socioeconomic status, lower class, or working class are surprisingly missing from the remainder of the document.

In the weighty 1992 *Handbook of Research on Mathematics Teaching and Learning* (Grouws), however, an in-depth chapter (one of twenty-nine) is devoted to "Race, Ethnicity, Social Class, Language and Achievement in Mathematics" (Secada). Secada described social class and noted that it may have only recently become a separate concern for educators because poverty and social class had been, at one time, viewed as synonymous with race. But terms such as race, ethnicity, and SES have since become differentiated into distinct groups.

> Socioeconomic status refers to some combination of familial income, education, and employment. Social class carries with it an overlay of shared group values concerning a range of social issues, differentiated roles in our society, notions of oppression, and struggles among members of different social classes for power. (p. 626)

He also noted a paucity of concern for poverty and social class in the research and mathematics-education reform documents. "Frankly, the literature does not bristle with same sense of outrage that the poor do not do as well in mathematics as their middle-class peers as it does with similar findings along other groupings" (p. 640). He suggested that since the relationship of poverty and low mathematics achievement had persisted for the last 40 years, the education community may have become resigned to what seems to be an inevitable association.

Published in collaboration with NCTM in 1995 was *New Directions for Equity in Mathematics Education* (Secada, Fennema, & Adajian) whose editors viewed the challenge…

> …in terms of recent developments. Scholarly inquiry has begun to focus on new areas through research in cognitive psychology; by making problematic such classically held notions as race, gender, social class, and even the goals of school itself; by using post-structural analyses and semiotics; by incorporating a range of perspectives and voices that have been previously unheard; and, in brief, by asking new kinds of questions from different points of view. (p. 1)

In addition to the chapters describing projects designed for mathematics instruction of low SES students, social context of instruction was discussed in one chapter, and in another, the special concerns of disadvantaged females in the mathematics classroom (Campbell, 1995). This publication may have steered the course to more attention for equity issues in general and particularly, poverty issues.

In 1997, the NCTM yearbook, *Multicultural and Gender Equity in the Mathematics Classroom: The Gift of Diversity* (Trentacosta) contained twenty-eight chapters addressing the teaching/learning aspects of gender, race, ethnicity, class, and diversity in general. One chapter specifically concerned SES and was written by then doctoral candidate, Sarah Theule Lubienski, who would later figure prominently in the study of social class and mathematics. She described a qualitative study conducted with 7$^{th}$ grade mathematics students in the Connected Mathematics Project. The other chapters occasionally addressed the issues associated with poverty in a generally indirect way, or combined with other factors or demographic groups.

Also in 1997, the NCTM Board of Directors appointed the Task Force on Mathematics Teaching and Learning in Poor Communities, and the group convened for a working conference in 1998. The participants, most with personal experience working in poor communities, agreed that efforts to improve mathematics education in poor communities should continue. However, the diversity of the group resulted in a "great amount of disagreement stemming from differing

philosophies, community contexts, prior experience, and semantics" (Campbell & Silver, 1999, p. 4). Perhaps this lack of consensus regarding the poverty factor in mathematics education foreshadowed the virtual absence of the concepts of poverty and social class from the *Principles and Standards for School Mathematics* (2000) and from other literature as well.

The recently published *Standards Based School Mathematics Curricula* (Senk & Thompson, 2003) is a compilation of essays from researchers who had investigated the implementation of 12 different curricula based on the 1989 *Curriculum and Evaluation Standards for School Mathematics*. They were charged with determining what difference in student performance occurred between those using *Standards*-based and those with traditional textbooks. For the most part, the studies were based on "mathematics for all", and no diverse groups of any type were addressed. Responding to the evaluations of middle grades textbooks, Chappell writes that "it was difficult to ascertain the extent to which the curricula were good for *all* students…The authors fail to clarify explicitly how *all* learners benefit from the curricula" (p. 292).

Little seems to have changed since 1989 when Margaret Meyer observed from reports issued on mathematics education that "the equities in mathematics learning were acknowledged, at least in passing," that "few specific detailed recommendations were made that would potentially change the situation," and that "recommendations were made to benefit *all* students" (p. 19). She questioned the assumption that what is good for the majority will also benefit the minority. Even though equity is rightfully receiving the bulk of the attention from NCTM in terms of mathematics achievement, the study of the effects of individual and school-wide poverty on student achievement is still imperative.

The ten Standards in the *Principles and Standards for School Mathematics* (2000) describe what students should be able to know and do through mathematics instruction and are divided into Content Standards and the Process Standards. The 1998 NCTM Task Force on Teaching and Learning in Poor Communities (Campbell & Silver, 1999) asserted that the mathematics content "should be the same content for students in poor communities as for those from more affluent communities – a separate content for students in poor communities is not advocated or supported" (p. 6). Another concern was for access to higher mathematics courses and the support poor students would need to be successful in them. The processes by which these students learn and demonstrate the learning of that content may differ. "Equity does not mean that every student should receive identical instruction; instead it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students" (NCTM, 2000, p. 12). Therefore the Process Standards which "highlight ways of acquiring and using content knowledge" (p. 29) should be questioned as to their applicability to all learners.

From the Problem Solving Standard, students should "monitor and reflect on the process of problems solving" (NCTM, 2000, p. 54) which would be challenging to students with limited ability to plan and predict. And to be able to "solve problems that arise in mathematics and in other contexts" (NCTM, p. 53), students must be able to recognize the mathematics in the contexts that arise and then transfer the mathematics to other situations. Working class students who are context dependent in problem solving may not identify or reassign the mathematics to other circumstances (Theule-Lubienski, 1997).

The Reasoning and Proof Standard includes making mathematical conjectures and creating mathematical arguments (NCTM, 2000). Students who are unused to questioning, who expect one right answer, and who are reluctant or unable to share ideas in the classroom forum

may not reap the same benefits as those who participate actively. Likewise in the Communication Standard are ways of sharing ideas and promoting understanding. To do so, students must "communicate their mathematical thinking coherently and clearly to peers, teachers, and others" (p.61) and "analyze and evaluate the mathematical thinking and strategies of others" (p. 62). Students from poor families may have limited language skills which would hamper their ability to communicate. In addition, students who are used to the teacher as authority will have trouble accepting the validity of mathematical strategies from their peers (Payne, 2001; Theule-Lubienski, 1997).

The last two Process Standards, Connections and Representations, require that students "recognize and use connections among mathematical ideas" (NCTM, 2000, p. 64), understand the relationship of mathematical ideas within a coherent whole and apply mathematics to other contexts. These networks of connections may not be in place for learners who live in poverty where life is based on a less abstract perspective. In addition, their contextual world may be limited in ways that the middle class students' are not. Participating in class discourse and being expected to listen, analyze and make connections and predictions may not be skills that lower class students can easily handle (Payne, 2001; Theule-Lubienski, 1997).

*Characteristics of Learners from the Lower Class Culture*

As part of her doctoral dissertation, Theule-Lubienski (1997) summarized the literature demonstrating differences in working or lower class and middle class culture. Parents' child-rearing practices in the middle class appeared to emphasize learning, intellectual curiosity, questioning, problem-solving and reasoning. She found that students in the middle class are: "are oriented to abstract meanings, ask more questions and show more doubt in the presence of adults, are more motivated by intangible rewards, and think a good teacher is one who knows the subject well and is creative in teaching it" (p. 244). In contrast, working class parents tend to value "common sense" knowledge and conformity, emphasize communicating contextually, and stress finding one right solution. As a result, students in the working class "are oriented to context-dependent meanings, ask few questions and show less doubt in the presence of adults, are more motivated by tangible rewards, and think a good teacher is one who shows she cares by explaining clearly and helping them understand" (p. 244).

Supporting the view that the culture of the home can either support or be at odds with the culture and norms of the school environment is Janine Bempechat in *Against the Odds: How "At Risk" Student Exceed Expectations* (1998). "In most cases, parents are probably not aware of the degree to which they impart critical information about the values they place on their children's education and the behaviors that they expect from children beginning their roles as students" (p. 25). She defined parental "academic support" as "the ways in which parents foster their children's intellectual or cognitive development" and "motivational support" as "ways in which parents foster the development of attitudes and approaches to learning that are essential for school success" (p. 26). Parenting styles contribute to a student's understanding of and ability to navigate the school environment.

A former school principal, though not a mathematics educator, Ruby Payne, in *A Framework for Understanding Poverty* (2001), also identified characteristics of students in poverty that may seem foreign in the middle class school environment. According to her, these students may (1) lack a consistent or predictable way of exploring or gathering data, (2) lack verbal tools such as vocabulary words, (3) have impaired spatial orientation, (3) lack the ability to organize in time, (4) lack the ability to keep memories of objects constant, (5) be unable to

gather accurate or precise data, and (6) be unable to hold two objects in mind in order to compare and contrast. Another problematic area is in the ability to plan. Planning involves predicting, identifying cause and effect, recognizing consequences, and controlling impulsivity. She states, "As we adapt and flex our instruction to meet the needs of these students, cognitive strategies, and support need to be integrated with insistence and expectations" (p. 139).

*Low SES Students and the Reformed Mathematics Class*

When Lubienski spent a year as a teacher-researcher in a heterogeneous 7th grade mathematics class, she studied students' response to and success with key ideas in mathematics education reform, particularly those students of lower-SES. She found that even though the curriculum and pedagogy enabled the higher-SES students to be confident problem-solvers, the lower SES students did not enjoy the same benefits but experienced more difficulty in the non-traditional classroom. She observed that the skills and beliefs the middle class students seemed to come to school with more closely matched the classroom culture (Theule-Lubienski, 1997).

The study demonstrated a connection between middle class students whose parents praised their accomplishments and risk-taking in discussions and problem solving. These students had confidence in their mathematical problem-solving and sense-making abilities, and they were less likely to seek the one right answer to contextualized problems. As a result, their view of the mathematical classroom as a community of ideas to be shared more closely matched that of the teacher, and the other students seemed to respect them in class discussions (Theule-Lubienski, 1997). "In the end, many higher-SES students found the curriculum and pedagogy mathematically empowering. Others did not" (p. 251).

The lower-SES students in the Theule-Lubienski study (1997) demonstrated less confidence in themselves as problem solvers and sense-makers. External motivation and reliance on authority for support and corroboration played a bigger role in those students' ways of negotiating the class because they were comfortable with a "right way" to think and with learning from an authority figure.

> In their discourse, the lower-SES students tended to be contextualized, with more of an emphasis on common sense knowledge and proof, with a black/white orientation toward knowledge. While the lower-SES students often engaged with solving the CMP [Connected Mathematics Project] trial problems set in real-world contexts, the "common sense" ways in which they approached the problems seemed to leave them missing the intended, more abstract mathematical point of the problem. Hence, although the lower-SES students would often attempt to solve the problems, they seemed to "get stuck" in the contexts, approaching the problems in ways that – although sensible – did not promote engagement with and abstraction of, the intended mathematical ideas. These students became frustrated because they did not see how work on one contextualized problem prepared them for later problems. (p. 251-252)

In addition, the lower-SES students participated in class on a limited basis, answering mostly the clear-cut questions when they were sure of the answer. Their fear of being wrong in class discussions was exacerbated by other students' disrespectful responses to their contributions. The lower-SES students found the discussions confusing, unsure of how to evaluate classmate's contributions. They were reluctant to delve into problem-solving or to take intellectual risks and were also unable or unmotivated to understand the problems (Theule-

Lubienski, 1997). “Instead of sharing my assumptions about our roles in the learning process, the lower-SES students found the curriculum and pedagogy confusing and frustrating – *dis*empowering instead of empowering” (p. 252).

Because Theule-Lubienski studied only 18 students, she refrained from drawing conclusions about how other low-SES and high-SES students’ understanding may differ in a reformed classroom. But after exploring literature on class cultures in the areas of problem solving and contextualization, she determined the questions that she raised were supported by the conclusions of others (Lubienski, 2000a). She also concluded that an open environment in the classroom where solutions are freely shared and debated might surreptitiously value middle class values over working class values (Lubienski, 2000b)

Directly challenging Lubienski’s conclusions, Jo Boaler (2002b) discussed her 3-year study of 300 middle and high school students in low income areas of England. The two schools used opposite teaching approaches for mathematics: one was procedurally based and the other, an open-ended approach. The procedurally-based classroom parallels a traditional teaching style in the United States, while the open-approach seems to closely match *Standards*-based teaching.

> At the beginning of that study, the cohorts of students at the two schools were matched by gender, race, and social class, and there were no significant differences in their levels of mathematics attainment at that time. Three years later, the students at the project-based school [Phoenix Park] attained significantly higher grades on a range of assessments, including the national examination….Thus, the school that used an open-ended approach not only achieved significant academic results for its students – whose examination results were higher than the national average, despite their school’s location in one of the poorest areas of the country – but also reduced the inequalities that typically correlate with gender or social class. (pp. 246-247)

The teachers at Phoenix Park (the *Standards*-based school) designed the curriculum and “developed a range of practices that served to increase the students’ access to the problems and the methods they were expected to use” (Boaler, 2002b, p. 248). Boaler described three such practices: “Introducing Activities through Discussion”, “Teaching Students to Explain and Justify”, and “Making Real World Contexts Accessible” (pp.248-250). The descriptions of the practices, though only a part of the teachers’ repertoires, “provide some indication of the complex support that that teachers using reform-oriented approaches may need to provide to students” (p. 235).

Boaler (2002a) emphasized the pedagogy of reformed mathematics rather than the curriculum itself and suggested it is the teaching practice that determines effective implementation of *Standards*-based content. She advocated collecting more evidence on the connection between equity and teaching approaches. She stated, “I have argued that Lubienski’s response is limited by the fact that it draws direct links between the curriculum and achievement, with no analysis of the *teaching* that makes the difference between equitable and inequitable approaches” (Boaler, 2000a, p. 36). Boaler (2002b) concluded, “The results of this study do not show that all reform [*Standards*-based] approaches are *best*, only that they can produce powerful understandings among students if taught well and are worthy of further understanding and investment” (p. 182). She also emphasized the variety of teaching practices employed by those at Phoenix Park, the school emphasizing the open-approach (Boaler, 2000a; 2000b).

*Future Considerations Regarding Mathematics Achievement of Students in Poverty*

"The righteous care about justice for the poor, but the wicked have no such concern" (Proverbs 29:7, New International Version). The needs of the poor have been a social justice concern since ancient times. Poverty encompasses a world of factors outside of the realm of education; nevertheless, education is one avenue of hope. With one out of every six students living in poverty in the United States (United States Department of Health and Human Services (2003), teachers, especially those in rural and urban areas, are likely to face these students who struggle the most with mathematics. Although "high expectations and strong support for all students" (NCTM, 2000, p. 12) is a goal in mathematics education; exactly what measures will help achieve that goal is not readily discernable. Historically and currently, programs to address the mathematics achievement gap have come from a variety of directions and have met with varying degrees of success. In addition to research in effective means of teaching mathematics to students of poverty, a cataloging of past and present findings would provide a framework from which to collect and build resources in order to make it available to teachers on the front lines.

Keefe, U. M. L. Reck, and G. G. Reck (1983) advocated research on learning in Appalachia more than 20 years ago: "Future research needs to focus on the multidimensional nature of Appalachian ethnicity and the complex ways in which it is related to the school experience of Appalachian children" (p. 218). In an effort to begin to understand the unique learning needs of Appalachian students, particularly in mathematics, so as to impact policy and teaching practices for students of that region, I considered the rich information I had already gained from talking to the college students I had tutored. A plan for capturing the rich experiences of those students while valuing their perspectives evolved into a qualitative research design based on developing understandings of learning in Appalachia from those who attended public schools in Appalachia.

# Chapter Three

## Research Methods

### *Purpose and Research Questions*

The purpose of this research is to explore the informal and formal educational backgrounds, especially in mathematics, of current and future elementary teachers who have grown up in Central Appalachia, an area of rural poverty.

My research questions are:

- What are the life stories of pre-service and in-service elementary teachers from Central Appalachia, and how do they view their experiences in learning mathematics?
- How did aspects of the Appalachian culture influence the participants' views of their own learning and capabilities in mathematics?

### *Research Method*

Given the contextual emphases of the research questions, the framework based upon sociocultural theory and the virtual absence of literature on mathematics education within the rural poverty of Central Appalachia, a qualitative study using an oral history approach was employed. Qualitative studies can observe context, identify variables, and describe the characteristics of the Appalachian culture, while life histories can reveal the experiences and perceptions of the individuals who live in the culture.

### *Life History Research*

Life history or life story as a qualitative research method is also known as, or is closely aligned with, oral history, personal narrative, and biography, implying “that there is someone else involved who inspires the narrator to begin the act of remembering, jogs memory, and records, and presents the narrator’s words” (Yow, 1994, p. 4). Rather than just a record of a person’s experiences, it becomes, in the re-telling, the construction of meaning of the experience from the perspective of the narrator and through the lens of the researcher in a context of place and time (Cole & Knowles, 2001). Life story research is particularly suited to learners and teachers because of its focus on making meaning from events and experiences. Connelly and Clandinin (1990) define narrative inquiry:

> Narrative inquiry is increasingly used in studies of educational experience. It has a long intellectual history both in and out of education. The main claim for the use of narrative in educational research is that humans are storytelling organisms who, individually and socially, lead storied lives. The study of narrative, therefore, is the study of the ways humans experience the world. This general notion translates into the view that education is the construction and reconstruction of personal and social stories; teachers and learners are storytellers and characters in their own and other’s stories. (p. 2)

Lawrence-Lightfoot and Davis (1997) expanded and characterized life history research to “capture the richness, complexity, and dimensionality of human experience in social and cultural context, conveying the people who are negotiating those experiences” deeming it “portraiture” (p. 3). Placing the emphasis on what is remembered, they explained, “It is a story that can only be told in retrospect because it seemed to evolve as much out of intention, autobiography, and

serendipity as it did from purposeful intention" (p. 3). The researcher cannot be neutral. "We engage in acts (implicit and explicit) of social transformation, we create opportunities for dialogue, we pursue the silences, and in the process, we face ethical dilemmas and a great moral responsibility" (p. 11). Resisting the "tradition laden effort to document failure," portraiture "is an intentionally generous and eclectic process that begins by searching for what is good and healthy and assumes that the expression of goodness will always be laced with imperfections" (p. 9).

McCray, Sindelar, Kilgore, and Neal (2002) used a life history approach to study African-American female teachers, employing the three-interview series described by Seidman (1998). The first interview is a "focused life history" (Seidman, p. 120) to put the related experiences in context. The second interview emphasizes details of those experiences, and in the third interview, the participant reflects on the meaning of the experiences. Seidman also recommended a 90-minute format and a two to three week time frame.

Coffey and Atkinson (1996) discussed narrative analysis as an improvement over the fragmentation of data caused by categorizing and coding although they stressed that no precise formula exists for the storied interviews. Stories do have a structure which might lead to a chronological organization, but the content of the stories can lead to the construction of themes that are revelatory of the individual, societal conventions, or the culture. Narrative analysis can "also be considered in terms of how the social actor tells the story, the sorts of vocabularies, and rhetorical devices used, how present and past experiences are contrasted, and the different institutions and people discussed" (p. 71). "In creating the aesthetic whole, we blend empirical choices and aesthetic sensibilities; we week to capture insight and emotion; we want to develop a narrative that both informs and inspires" (Lawrence-Lightfoot & Davis, 1997, p. 259). The narrative that results from a series of interviews involves intuition as well as skill.

Life story, oral history, or narrative research methods may be particularly appropriate for studies in the context of Appalachia, as my study is. In an introduction to *Bloodroot: Reflections on Place by Appalachian Women Writers* (1998), Editor Joyce Dyer describes what inspires and nourishes the writers in this volume:

> These writers talk frequently about the importance of the stories they heard growing up, or the oral history of their region, stories that spilled freely from the mouths of neighbors and relatives and friends. They breathed in those stories, the oxygen of their future work. (p. 8)

Participants with an Appalachian heritage are likely to be more comfortable with data gathered through story-telling and interviews (Byers, 2004), especially by a native Appalachian researcher who values the individuals, the culture, and the dialect (Bragg, 2005; Evans, George-Warren, & Santelli, 2004).

*Researcher Lens*

Many parts of my own background contributed to my decisions in the research design and will color my interpretation of the data. My interest in mathematics competency and achievement for students in areas of poverty arises from my experiences as a student and as a teacher. I am a 47-year-old white female, born and raised in McDowell County, West Virginia, in the heart of rural Appalachia. My parents held a deep respect for education, and although neither of them graduated from high school, they obtained General Education Diplomas [GED]

and held responsible positions in the community post office. I attended a small rural elementary school with two grade levels in each room where I was often recruited to help tutor the other students. Once, a classmate was called out of class to take her cow home because it had followed her to school. Though not a farming community, some people in this small Appalachian community raised large gardens, along with chickens and cows, for food.

In 1976, I graduated as valedictorian of 109 students at Big Creek High School. Although I, along with three boys, had wanted to take advanced mathematics in my senior year, we were not assigned a teacher; we were just expected to work together on textbook assignments for the assistant principal to grade once a week. I felt unprepared for college mathematics and had to work hard to overcome my lack of available high school courses.

With a college degree in English education and a minor in mathematics, I was hired by telephone to teach junior high English and mathematics in McDowell County. After the first year, I taught only mathematics, 6$^{th}$ grade through Algebra I. I spent the next three summers working on my master's degree, hoping to strengthen my mathematical knowledge, but so few mathematics courses were offered in the summer or at night, that I was only able to minor in it again. My 16 years of teaching mathematics in junior high and middle school were challenging, but rich with experiences and opportunities. A majority of my students were poor and came from homes with priorities other than education. In 1990, the child poverty rate in McDowell County was 50.3% (Annie E. Casey Foundation, 2003), and about 85% of the children in the schools where I taught received free or reduced lunch and breakfast. With a regular teacher's salary, I was considered "rich," and by comparison, I was. In addition, I spent most of those years seeking out ways to be a more effective teacher to students of limited means because I thought a solid education, especially in mathematics, held promise of a brighter future for these children.

In 1996, I moved to neighboring Mercer County, West Virginia, and began to teach part-time in the Teacher Education Program at Bluefield College where I had graduated in 1980. Bluefield College is in Virginia, but many of the students are from the surrounding rural areas in both Virginia and West Virginia. *Praxis I* had just become a requirement for licensure in Virginia, and with my background of teaching mathematics, I began to help these students prepare for the *Praxis I* Mathematics and to tutor those who had failed to make the minimum score. In working with the students and this test, I saw a connection between the skills and content areas they were reviewing and the mathematics I had taught in middle school. The students I helped were eager to learn, and I saw in them the potential to learn the mathematics they needed. During our time together, the students shared memories of their mathematics classes and other school experiences. The conversations with those students, combined with my teaching experiences in an area of rural poverty, led to the research questions for this study.

*Participants*

In my experience as tutor for the *Praxis I* Mathematics test, I have met a number of young adults who, by many measures, would be considered successful. They had graduated from high school and were making adequate grades in college courses, including mathematics. Yet, after taking the *Praxis I* Mathematics test and failing to make the minimum scores needed for admission to the Teacher Education Program at Bluefield College, most of these individuals expressed doubts about their overall abilities and whether they were worthy of entering the teaching profession. I was troubled that their performance on one multiple choice test seemed to negate their images of themselves as successful and capable. I talked with them informally about their school experiences and became intrigued about their learning experiences in mathematics

and their overall school experiences. Since they had all attended school in Central Appalachia, I wondered how that culture may have impacted their learning.

Using purposive sampling (McKnight, Magid, Murphy, & McKnight, 2000), I invited three individuals to participate with me in constructing their life histories. I selected them on the basis of three criteria: Each participant had to have attended public schools in Appalachia for kindergarten through twelfth grade, had to have taken the *Praxis I* Mathematics test at least 3 times before achieving the minimum score, and had to currently be a pre-service or in-service elementary teacher. Because I have successfully tutored many individuals for the Praxis I Mathematics test, I have made many contacts with people who have a similar interest and who refer individuals to me. All three of the participants were college graduates whom I had tutored for the *Praxis I* Mathematics test.

*Data Collection*

During initial contact by telephone, email, or face to face, I explained the research project and, at that time, asked each person to sign a consent form (see Appendix A: Informed Consent), which they did. I asked permission from the participants to audio-tape the interviews (See Appendix B: Interview Protocol) and to photocopy their report cards, test data and other documents for further analysis. The interviews took place between March 2004 and April 2005 (see Appendix C: Interview Schedules). I informed the participants that they would read the transcripts for accuracy and be invited to submit revisions, questions and additional comments by mail, telephone, or email over the course of the study. Throughout the research process, I collected artifacts from the participants that they chose to share with me to help them reconstruct memories of events or to provide a catalyst for expression of ideas and perceptions. These included photographs, *Praxis I* score reports, college transcripts, public score report cards, textbooks, school work and projects, newspaper clippings, teacher notes, awards, and other documents focusing on their school experiences. Individuals brought these to me throughout the interviewing schedule.

Near the end of the interviews, I asked each participant to draw a graph or chart of her self-assessed mathematics ability and confidence throughout her years of public school and to place memories within a context of time and place using a chart of school and mathematics memories for each school year (see Appendix D: Questionnaire). Displaying their mathematics learning holistically through this chart allowed the participants to consider their levels of ability and confidence relative to each year. Because the directions to the participants were deliberately minimal, each chose to use a different graph with widely differing scales.

Participants were given the opportunity to write a reflection on their learning experiences in public school prior to the first meeting. In life history research, exploring context provides a reference for understanding influences on the life and experiences of the individual and can be revealed through conversation; such contextual influences include facets of family, community, and education (Cole & Knowles, 2001). As a result, participants were encouraged to elaborate on place and time within their re-telling of events.

*Pilot Study*

To clarify my research objectives, to refine my interviewing questions and techniques, and to become aware of additional important literature connections, I conducted a pilot study, as suggested by Seidman (1998). From the Virginia Tech Institutional Review Board, I obtained an Expedited Approval for 12 months beginning March 4, 2004 (see Appendix E: IRB Expedited

Approval). Using the data collection techniques of a written questionnaire, 3 semi-structured interviews (See Appendix B: Interview Protocol), email/telephone conversations, and document analysis, I completed a case study of one young women who had taken the *PPST* – Mathematics test 6 times before passing it on the 7th attempt and gathered interview data from another young woman about to begin her first year of teaching. From these studies, I identified additional important issues to investigate, such as confidence and comfort level of mathematics in and out of the classroom. Reading the transcripts taught me that I am not the teacher in an interviewing situation and over-explanation of the question may result in superimposing my ideas onto my participant. I also refined my interview protocol, asking more open-ended "grand tour" questions (Spradley, 1979). My investigation into the literature was broadened to include learning about particular obstacles to achievement in mathematics in Central Appalachia. Writing the research report for the one case study allowed me to refine my narrative writing style.

*Participant Interviews*

After my research questions changed to encompass the life stories of individuals, I applied for and received an Expedited Approval (IRB#05-089**)** for 12 Months from the Virginia Tech Institutional Review Board, beginning February, 2005 (see Appendix F: IRB Expedited Approval). I asked my pilot study participants for a fourth interview to revisit their school stories and to construct a chart of their self-assessed mathematics abilities; they agreed and signed updated consent forms. Because my third participant lives out of state, I contacted her by mail, and she returned the consent form. I interviewed her twice at her apartment in a remote city and once at my office at Bluefield College. (See Appendix C for the Interview Schedules.) I had additional contacts with all participants by telephone, mail, or email whenever I had a question or when they thought of extra memories to add to their stories. All were given transcripts to read to check for errors in meaning (although being teachers, most corrected misspellings and grammar mistakes); they were also given a copy of their completed story to check for accuracy of meaning and chronology. No mistakes in story content were noted by the women. At the end of the research project, I plan to give each one of them a binder with a copy of their story, copies of their corrected interview transcripts, and in protective sleeves, the artifacts (school records) that they entrusted to me.

*Analysis*

My preliminary plan of analysis included organizing the transcript and document data both chronologically and categorically as suggested by Yin (2003). Because my research questions focused on the life histories of the participants, the first step involved sorting the data chronologically along a timeline of school grade levels, one of the analysis methods suggested by Coffey and Atkinson (1996). As I read through each interview, I noted the corresponding grade levels for the memories of experiences in order to put those experiences within a time frame. Next, I used the cut and paste function of the word processor to consolidate quotes from each time frame into a single document with interview and line numbers for identification. Those were organized as follows Primary Grades, Intermediate Grades, Middle School, High School and College. From those I was able to weave together a story of their public school years, and due to the emphasis of my questions, a chronicle of their experiences in learning mathematics.

Because my research questions emphasized contexts of family, community, and culture, important issues which spanned multiple years began to emerge, and I felt that understanding those larger issues required examining all the references to those topics within the interview

transcripts. So I went back through the transcripts with those ideas in mind, to begin coding with the process described by Rubin and Rubin (1995). The additional categories were *Praxis I* Mathematics, Appalachia, and Family. All three of the women had struggled with the *Praxis I* Mathematics and that experience seemed to provoke similar feelings of inadequacy in mathematics. Family was mentioned in a positive way in regards to their education, and familism is one aspect of Appalachian culture (The Rural and Appalachian Youth and Families Consortium, 1996). Because one of the participants is African American, race became an additional category for her. At the end of the last interviews, all three women had reflections about the memories that had surfaced, influencing their perspectives about their schooling and connections to their own teaching experience. So Summary Thoughts became another category. After I finished all the interviews, I emailed the participants and asked them how constructing their life stories might have influenced them as teachers. Two responded by email, and one by U.S. mail. Once again, I used the cut and paste functions of the word processing program and organized quotes from the interviews under the above categories.

While each life story could have stood alone with much insight to offer about the learning experiences of each individual, obvious similarities among the stories surfaced. To consider the cross-case similarities, I began by studying their constructed charts of self-assessed mathematics abilities and confidence levels. There I observed certain parallels. For example, all three women had shown high estimated ability in the primary grades that dropped to low estimated ability in the middle grades. I examined how the dramatic highs and lows may have related to teacher practices, courses taken, and their responses to difficulties in mathematics.

To further investigate the similarities in the high and low points on their charts, I reread the transcripts and the completed stories. The participants' memories of themselves in mathematics classes revealed similar fears, such as reluctance to ask questions of the teacher. In addition, I looked at the responses to my specific questions, such as the one about the Appalachian image, where the responses of the women showed a similar recognition of the negative stereotypes.

*Limitations*

The first limitation to consider is that documents available regarding past school achievement will vary between the individuals and may not exist for some. In addition, participants will be asked to remember experiences from as much as 15 years ago. To help overcome this limitation, Seidman (1998) suggests to, "Ask participants, in effect, not to remember their experience, but rather to reconstruct it" (p. 74). Ways to encourage reconstruction of the past home and school events were to ask probing questions and to use participants' responses to delve deeper into issues on subsequent interviews and journal entries. Documents and artifacts that the participants chose to bring to me were also used to trigger memories of important past events.

A second limitation lies within the researcher herself. "In a qualitative study, the investigator is the primary instrument for gathering and analyzing data;…[however]…the investigator as human is limited by being human – that is, mistakes are made, opportunities are missed, personal biases interfere" (Merriam, 1998, p. 20). With my 16 years of public school teaching experience and 8 years of college teaching experience, I am so accustomed to scaffolding and encouraging students in the context of teaching and learning that it is hard not to do that in a non-productive way when interviewing the teacher candidates. I must be vigilant in my interviewing and my data analysis, so I do not look for blame among these entities or

influence my participants' views to that end while neglecting to examine all factors that present themselves in the data. Because I was not afforded opportunities to take higher mathematics classes in high school more than 25 years ago, I must not assume that no opportunities existed for the individuals in my study. I did, however, explore their high school course options in mathematics to understand what courses were available, and then I sought to understand their decisions to take or not take existing courses.

*Quality Considerations*

Cresswell (1998) used the term verification in place of validity and viewed it as a particular strength of qualitative research. He suggested procedures that help verify results, among them are the ones I used: triangulation, peer review, unconcealed researcher bias, member checks, and "rich, thick description" (p. 203). Using document sources, such as report cards and test data, along with my observations of the mathematics skills of the participants provided triangulation with the interview data and the written data that the participant provides. For member checking, the participants were asked to read and correct transcripts and completed stories, and to continue to communicate with me through, mail email and telephone calls as additional memories surface or as new insights arise.

My background as a student in the public schools and as a teacher of middle school mathematics in this geographical area provided the impetus for the direction of my research. I continued to examine and re-examine my ideas and biases, explicitly stating them in the research report, and I continued to learn and to refine my interviewing techniques to refrain from imposing my thoughts on the participants. Using quotes from the participants and reporting their narratives holistically using important details, in addition to the descriptions of the contexts and the participants themselves, paints a vivid picture full of detail that will enable the reader to make meaning from the research report. As drafts of the research report were completed, I asked colleagues to read and respond with suggestions, questions, and corrections to provide an external view of my research decisions and processes.

*Constructing the Stories*

The interviews, email and mail correspondence, telephone calls, and informal conversations, as well as the participants' hand-drawn charts of their levels of comfort and ability in mathematics throughout public school, were the raw materials from which I constructed the participants' life stories. Placing their recollections and reflections within a chronological timeframe produced compelling narratives of what it means to attend school in this region. Each story is unique, yet I identified with them in different ways as a native Appalachian with teaching experience in Appalachia. The three results chapters that follow are those stories: Laura's, Faith's and Petyon's.

# Chapter Four

## Laura's Story

I came to know Laura[9] more than 5 years ago when she was a student in the Teacher Education Program at a small private college. Her academic advisor had suggested that she come to me for help in studying for the *PRAXIS I* Mathematics test, one component of the basic-skills test required for teacher licensure in Virginia. Although she had easily passed the other two parts of the test, reading and writing, she struggled with the mathematics, taking it 9 times without attaining the minimum score. We arranged times for me to tutor her in mathematics.

As we began to explore mathematical topics, I noticed how well Laura was able to solve problems related to Algebra I, a course that she had taken in high school, but struggled with topics from middle school mathematics (such as operations with fractions and percents, simple probability, geometry, and measurement). So I got an eighth grade mathematics textbook, and we began to work through it together. She was very dedicated to learning the mathematics and seemed to pick up the concepts quite easily. Because geometry was a lower scoring area, we focused on that quite a bit. I brought in physical models, such as polyhedral shapes and color tiles; she learned the geometric topics very quickly. She took the Mathematics test again and her score rose dramatically. She finally passed it on her 11th try.

Throughout our tutoring sessions and conversations, I began to wonder why Laura was not able to successfully pass the mathematics portion of this test. Years later, as I began my doctoral program, that question plagued me – for now I had tutored many individuals from Central Appalachia who struggled mightily with passing the *Praxis I* Mathematics test. I knew, as I began thinking about the focus of my dissertation, that I would ask Laura to tell me the story behind her mathematics education. When I wrote to her in February 2005, and asked her to be a part of my study, she immediately signed and returned the consent form. Her story helps to address my research questions:

- What are the life stories of pre-service and in-service elementary teachers from Central Appalachia, and how do they view their experiences in learning mathematics?
- How did aspects of the Appalachian culture influence the participants' views of their own learning and capabilities in mathematics?

### *Current Status*

Laura is a 28-year old African-American female, born and raised in Central Appalachia. She earned a bachelor's degree, along with a teaching license, at a small private college, and a master's degree at a large state university. After teaching for two years in Virginia, she moved to be near her fiancé who is pursing a graduate degree at a seminary. Laura currently teaches in an urban elementary school in a nearby state in Southern Appalachia. She participated in three interviews, two at her apartment, and one at my office. In addition, she read and made grammatical and spelling corrections, added a few notes of additional memories and details on the transcript of the first interview, and has read and verified the other two transcripts and a copy of this chapter, her life story.

At the end of the second interview, I asked Laura to draw a chart or graph of her public school years from kindergarten through 12th grade, using what ever scale she determined to indicate her ability and confidence with mathematics at each grade level (Figure 1). During the

[9] "Laura" is a pseudonym, and so are all other names of individuals, schools, and towns.

third interview, she spoke about the graph to further describe her choices for each grade level. She explained her choice of scale:

> And what I've decided to do is to do my graph in intervals of twos, my zero being the lowest and twelve being my highest point and sixth being in the middle because there were definitely some years that I was in the middle. I'm going to start at Kindergarten and I would say in Kindergarten, I would probably give myself about a twelve because I knew how to count. I knew my numbers forwards and backwards. I was very happy. (Int. 2, L. 914-919)

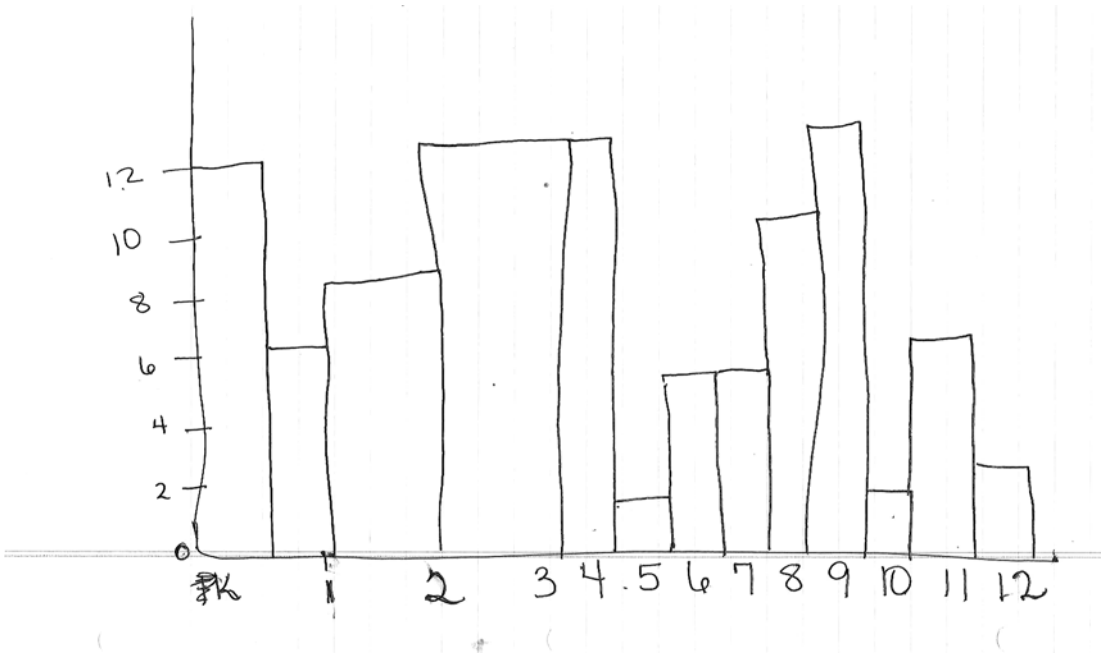


**Figure 1:** Laura's Graph of Her Interest, Capabilities, and Confidence in Mathematics for each year of Public School from Kindergarten through 12th Grade. She used a scale of 0 through 12, with 0 meaning the lowest point, 12 the highest, and 6 in the middle.

The chart provided an overview of Laura's mathematical memories in the years she attended public school and a way to consider the years relative to one another.

*Primary School*

Laura lived in a small town surrounded by areas of small rural farms and Appalachian Mountains. She began kindergarten in a primary school housing grades K through 2 with about 350 primarily white middle class students. She was an extremely shy child as she explained in one of the first memories that Laura related to me:

> The first thing that comes to my mind is when I stepped into a kindergarten class at Pinewood Primary school, and I remember there was Ms. Jennings and Ms. Barton. And I remember being told in kindergarten that I would never amount to anything. (Int.1, L. 15-18)

Laura started kindergarten being able to read (Int.2, L. 213) and with high interest in school, as shown from the graph of her interest, confidence, and ability in mathematics (Figure 1). Laura summarized her kindergarten year as a time "when you're told as a five year old that you'll never amount to anything because you would cry all of the time and the teacher was so mean to you" (Int.1, L. 120-122).

"Based on experiences with my [kindergarten] teacher" (Int. 3, L. 14); "my confidence had been shaken quite a bit" (Int. 3, L. 16) upon entering first grade. She described herself then as "a shy student; I had really thick glasses, and I stuttered all the time, and had a learning disability" (Int.1, L. 20-21). Laura's learning disability [LD] was diagnosed in first grade. When I asked her in what area the disability was found, she answered:

> You know, I don't know. If I had to remember, I think it was reading, maybe, which is really strange because I could read before I went to kindergarten. So I'm kind of wondering now if maybe because of my bad experience in kindergarten again, I kind of lost everything that I knew. I did stutter a lot in first grade. (Int.2, L. 213-216)

Because Laura received special services for her "learning disability" only during first grade, she came to the conclusion that the "disability" may have been a created one. Laura recalled:

> I received speech [services], and when I stuttered I did have problems pronouncing the words. I also had something called a frontal lisp, and that was a family trait. So between my stuttering and my frontal lisp and my shyness and forgetting everything in kindergarten, I'm sure it probably would have created a disability. (Int. 2, L. 220-223)

Laura was not bothered by the LD label because her first grade teacher, Ms. Dawson, "never glorified it" (Int. 2, L. 233-234), and she enjoyed going out to a special room to read with the other teacher.

Laura began to flourish in first grade with Ms. Dawson, who told her that she could do anything she set her mind to do, and, as a result, she decided at that time that she wanted to be a teacher. Ms. Dawson's encouragement helped her overcome the feelings of unworthiness from kindergarten. Laura recalled those feelings:

> I felt worthy because she accepted me for who I was. She didn't try to make me something that I was not. What I really appreciated about Ms. Dawson was the fact that she treated me as an individual. I just wasn't a student in a classroom. I was an individual. I had my own thoughts, my own ideas, my own weaknesses, my own strengths and when I couldn't do something, just by her giving me small sequential steps and allowing me to master the smaller things made me want to accomplish even the most challenging things. I always felt rewarded in her class. (Int.2, L.23-32)

Her first grade teacher also helped restore a love of mathematics:

> Ms. Dawson had counters for us to do addition and subtraction"…From Ms. Dawson,…I had a change of attitude from the teacher. For instance I was told "I can do it'"instead of I couldn't. (Int. 3, L. 473-474, 477-479)

Second grade was another happy year with Ms. Lester, “a grandma type” (Int. 1, L. 27) who helped develop her skills as a writer which helped her gain confidence and deal with her shyness. Describing Ms. Lester, Laura said:

> She was a lot like Ms. Dawson, and she taught me so many things about math, things that I could identify within my own environment, so I really loved math. From second to third grade years my math interest continued to climb from an eight to a twelve [on the chart]. (Int. 3, L. 20-22 and Figure 1)

*Intermediate School*

Laura entered Parnell Intermediate School for the third through fifth grades without carrying the label of learning disabled. Quite the contrary, she tested into the gifted program:

> Third grade was a year of surprises because in third grade, after originally being diagnosed with a learning disability in math in the first grade, I was tested for the gifted program. And I found out that I was gifted in math, reading and writing. That was quite a surprise. (Int. 1, L. 31-34)

The day she met the gifted teacher was quite clear in Laura’s memory:

> I remember the day Ms. King [teacher of the gifted] came… and she told me she wanted to talk to me for a minute just to have a conversation with me. She sat down, and she asked me the difference between a hoagie and a submarine or something. I don’t remember but it was something strange about food. I guess she thought that was something every child could identify with. We had sat down and she had talked... I do remember her saying that I had a very good vocabulary to be so young. After the tests were administered, the results were given that I was gifted, but my teacher felt that because I was so shy that I wouldn’t benefit from gifted so I was denied to participate in the program that year. (Int.2, L. 252-261)

Laura did not think so at the time, but upon retrospection, she believed that keeping her from participating in the gifted program for that year worked to her benefit.

> I knew she [the classroom teacher] did the right thing because had I been immersed in the gifted program at the time I don’t think I would have done as well as I could have done. But I did learn a lot about myself third grade year. I grew. I grew inwardly and I grew outwardly as a person. (Int. 1, L. 37-40)

In third grade mathematics, Ms. Dillon used egg cartons and learning centers, among other things, and the children had to memorize multiplication facts for the twos through fives.

> Then I remembered the Sugar family story for subtraction. There was a mother, a father, a brother, a sister, and a baby, and I remember because she always used the Sugar family as a way of teaching us about borrowing. I think that was so interesting for me because I never would have thought sugar, borrowing a cup of sugar, same thing in subtraction

> borrowing tens. So that definitely created another memory for me in math. (Int.3, L. 450-455)

Overall, Laura had vivid memories of mathematics activities in third grade. “We would do all kinds of fun manipulatives with math, so I thoroughly enjoyed math” ( Int.3, L. 25-26).

Moving to fourth grade brought a new teacher, Ms. Berkley, who promoted competition in mathematics for memorizing multiplication facts. Laura did not like her as well at the time, but viewing that grade as an adult, she thought she learned a lot that year:

> So when I went to fourth grade, Ms. Berkley… helped me gain a lot more confidence because of a game called Hot Seat. Hot Seat was a multiplication game, and I always won because I had memorized my multiplication facts the quickest. And that one game gave me the confidence and the love of math that I always didn’t know I really had. It made me realize that, “You know what, I am worth something; I am valuable.” Ms. Berkley really saw that. She, too, encouraged my gift as a writer, and she really helped me develop my writing skills. She challenged me beyond my wildest dreams. I remember I didn’t like her very well but looking back I’m thankful that I had her because of all of the things that she taught me. (Int. 1, L. 41-51)

> She wouldn’t allow me to just to sit back and take the easy way out because I was gifted. She pushed me and pushed me until it hurt. I am thankful that she did that because if she wouldn’t have pushed me out of my comfort zone, I would just have continued to use writing as my mechanism to express my confidence. So, I was thrilled looking back that I had a teacher that cared enough about me in spite of everything. (Int. 1, L. 61-67)

She deems Ms. Berkley as “excellent” (Int. 3, L. 27) and remembers that she would customize assignments for students in their areas of interest. “My two topics that I was interested in at the time were, of course, writing and math.” (Int.3, L. 29-30)

An excitement and interest in mathematics soon changed when Laura entered fifth grade, her last year at Parnell Intermediate. She continued:

> I think after fourth grade my love for math and ways to excel began to dwindle. My story starts with my struggle in math in fifth grade. I had a teacher named Ms. Workman. I was very excited about learning and math and wanted to learn all I could, but she told me that women do not do things like that. Women are not designed to be engineers; math is what men do. It’s hard to believe, looking back from sixteen years later, that that mindset is still clear to me now as I’m talking about it. From then on I shut down in math that year. I was always excited and eager to learn math and to do math. I picked up really quickly on it until she told me that. I don’t think that she really realized how profound it was because the rest of the fifth grade year I could not do math. I think I put a mental block inside my mind that said “Laura, you can’t do this.” (Int.1, L. 78-88)

In describing how this negative message was communicated to the class, Laura remembered:

> For instance, like if I raised my hand in class and I knew the answer, she would purposely overlook me and she would call on the boys. She would always push us as girls to do

> more girly things. If we had a problem in math and we had a question about it, she would get a boy to show us how to do it. (Int. 1, L. 92-84)

From her memory, Laura believed the class to be about equal in terms of girls and boys, primarily Caucasian with three African American students. As far as economic level, she recalled distinct class differences:

> Economic level in my class was probably more ritzy, wealthy children and then it was a few middle class, I was fortunate to be in middle class, and then the rest of them were really low in poverty. (Int. 2, 129-131)

Perhaps the class differences played into who would take the math placement test for middle school.

In fifth grade at Parnell Intermediate, a mathematics placement test was given to determine which mathematics classes those students would take when they went to the middle school. Laura was not given the opportunity to take this test, and the memory of it still hurt and puzzled her as an adult:

> What happened was, when you're in fifth grade they determine whether or not you're able to have higher mathematics in sixth grade. They want to figure out where you belong. It's totally based upon teacher recommendation. Parents did not have a choice in the decision. What happened was, Ms. Workman chose certain children to take the test, and if you didn't get to take the test, then you were just considered an average student who wouldn't be given the chance to have any higher, more challenging things to do…I believe that it would have been much more fair if the test would have been given to us as a whole so that we could all have seen what we could or could not do. We should have least been given the chance, and she selected the boys to take the test. There was not one girl. Her reason being that men needed the math, we didn't because she did not have the idea that women could be anything in terms of mathematically oriented, like engineers or anything like that. (Int.2, L.47-63)

The injustice of that lost opportunity not only affected Laura's mathematical learning that year, she also lost interest in school altogether:

> So from then on it was just down hill for me because I remembered I was gifted, and I didn't understand in the fifth grade year when I was getting ready to go to middle school why I wasn't allowed to take the test for advanced mathematics. That's what I wanted. I wanted to be in the advanced mathematics class, and my mom asked her about it and she said my math scores weren't high enough. But how much higher can you go than an A? So she picked all the boys. There were no girls that were chosen for middle school math and I shut down after that. (Int.1, L. 101-108)

> In the other subjects I shut down. It affected me completely and I shut down. I begin to hate school. I did not believe in myself anymore. I always had writing or math I felt to make me feel that I was just as good as anybody else.… Once she opened up my eyes and told me I could not do math then everything else around me, I couldn't even write

> anymore. I just did not want to write. I loved to write stories. I stopped writing. I stopped trying. I stopped studying. My whole academic experience that year was awful. (Int.1, L. 117-127)

As Laura indicated on the chart of mathematics progress (Figure 1), the estimate of her mathematical confidence and ability dropped considerably in Grade 5, but not to zero. She continued to receive gifted services from Ms. Carter which consisted of special field trips, Brown Bag Lunches, extra mathematics homework, group projects, and a peer group to talk with. But she did not receive enrichment in the regular classroom for mathematics, or any other subject.

*Middle School*

Laura switched from a self-contained classroom to middle school for 6th grade. Still reeling from the loss of confidence and self-esteem in 5th grade, Laura looked forward to the change in schools in the midst of her own physical and emotional changes:

> From sixth to eighth grade I was just trying to be comfortable with who I was as a developing young woman and trying to find my place again and where I belonged in school because fifth grade had just shut me down. It had taken away all of my confidence and all of my self esteem and so I was really excited about going to sixth grade, until I met Ms. Browning.
>
> Boy Ms. Browning was a work of art. She was very mean. She had me moved from her class because I had missed an assignment, and she talked about my mother. She upset me so awfully. I had her for Language Arts, and Language Arts is supposed be my favorite subject. Once again, I shut down.
> (Int. 1, L. 156-165).

Laura viewed her removal from Ms. Browning's class "a blessing in disguise" because she was placed for Language Arts and for Social Studies in class with Ms. Dovey, who "honed in and recharged my love for learning" ( Int. 1, L. 167-168).

Laura began to gain confidence in mathematics, too, with Ms. Driver for 6th and 7th grade mathematics:

> So, I was more excited to go to math with Ms. Driver in sixth grade. I had Ms. Harriet Driver in sixth grade, and she was an awesome math teacher. She wasn't the same Ms. Workman that I knew in fifth grade. She taught me a lot of basic skills with math. She did try to help encourage me as much as she could. She was a very challenging math teacher, but I do think that a lot of my background knowledge in math kind of plagued me again. Because after I shut down in fifth grade, in fifth and sixth grade the skills kind of build on each other and I was really challenged and math was really hard for me. I still made a strong B though. I made B's in math but it was really hard for me. She tried to make it exciting and I did at least learn to like math again. (Int. 1, L. 180-189).
>
> I think as I think about it, it was probably later upon thinking about it that I realized that might have been my gap in learning but I do remember in seventh grade, we were learning word problems and I had a flashback. I said, "Oh, this is when Ms. Workman

> taught us word problems." And after I had shut down, I believe that is what had happened, I had lost the fundamental skills needed to gain there and Ms. Driver would kind of jog our memory too. She would say, "Well most of you have learned this by fifth grade, before you get here and if you don't, then I'm going to show you how to do this." (Int. 2, L. 198-205)

Even though Laura felt a little behind in the mathematics due to her limited mathematics experiences in fifth grade, she knew that she had missed the opportunity to take the more advanced mathematics classes and longed to take that challenge. I asked Laura, from her perspective now as a teacher, if she viewed her middle school courses as an example of academic tracking:

> I believe it was. I believe it was. Based upon, again trying to group all of the children. I guess they were trying to group all of the children together because if I recall correctly in middle school every ability level was grouped together so all of us average group kids were together, all of your higher kids were grouped together and all of the low were grouped together. (Int. 2, L. 344-348)

I then asked Laura if the fifth grade placement test that she and other girls in her class were not allowed to take was used to determine other classes in addition to mathematics classes for the middle school.

> Exactly, it [the fifth grade placement test] determined your track in middle school, and I definitely believe it was tracking. Looking back I guess I didn't have the educational jargon that I have now but it was definitely tracking because I think back to seventh grade with Ms. Carter, and I was grouped in the average group. Some of the things that she taught me after I learned it, it was way too easy, but I was in this tracking system so I couldn't go anywhere. (Int. 2, L. 352-357)

Not only was Laura sentenced to the middle track for mathematics in middle school, she also did not have gifted classes. She recalled:

> They ceased. There were no gifted opportunities from sixth to eighth grade…I guess that's why I really wanted to be in that math class because there really wasn't anything special. There really wasn't anything extra or special about gifted education. In eighth grade when I got ready to go to high school, miraculously, there was going to be a gifted program the next year, but, of course, I wasn't going to be there. I didn't have one for three years. (Int. 2, L. 331-340)

Nevertheless, in sixth and seventh grade mathematics, Laura regained her confidence and interest in mathematics. That confidence grew in eighth grade mathematics with Mr. Thomas. On her personal mathematics scale [Figure 1], she put her eighth grade year at 10 out of 12.

> At the end of seventh grade I was ready to enter eighth grade and those two years had really shaped my confidence so by the eighth grade year I had a ten. The ten represented an interest because I had Mr. Thomas, and Mr. Thomas was absolutely wonderful. We

> did polyhedrons, we did all kinds of things that allowed me to use my mathematical side that I used to have in fifth grade and surprisingly I found it again. (Int. 3, L. 47-51)

In addition, Laura remembers enjoying the creative writing assignments and science projects in her other classes. She had grown in other ways, too. She remembered:

> Eighth grade was fun; I was elected as the vice president of the upcoming freshman class. I was no longer shy. I used to barely speak and then I would now raise my hand in class and speak up and demand to be heard. I became very outspoken. I made more friends more easily because of that. I wanted to go out and meet people and I found myself helping other people that used to be like me, shy, reserved, didn't think I had an opinion. So I just blossomed. Eighth grade was a great year. I took all kinds of fun classes that year. (Int. 1, L. 277-283).

This painfully shy kindergarten student would become vice-president of her freshman class at the high school, putting her at a better place to start a new school.

Another placement test in eighth grade was given to decide the English courses that the students would take in high school. This time the test was given to everyone, and Laura did very well on it, although she was a bit anxious after her experience in fifth grade.

> In eighth grade, I had to take a test for high school, and you can imagine based upon fifth grade, I just knew it was going to be awful. But actually in my eighth grade year, Ms. Dovey saw that I had a gift for writing, and she put me in the test. And this time, miraculously, this time all grades, all subjects were, all of us in that class were allowed to take the test. It wasn't any random choice or anything. We all took the test. (Int. 2, L. 632-637)

As a result of the test, Laura was placed in Honors English courses during her four years of high school as **"**one of thirty children that scored very high." (Int. 2, L. 644-655)

*High School*

Laura entered high school with more advantages than being in Honors English and serving as Vice-President of the Freshman Class; her older brother was a senior there. She recalled her first year of high school:

> So, I went to ninth grade at Parnell High School. Ninth grade was definitely a fun year. I felt like a small fish in a big pond, but I had my older brother, who was a senior there to help me. I was able to take a more active role in my learning; I chose classes that would stimulate me and would make me feel like I was doing something right because I wanted to be a teacher. And I knew these next four years would be a time for me to get my life right. It would be a time for me to get everything in perspective. (Int. 1, L. 293-299)

Laura took Algebra I in the 9$^{th}$ grade from Ms. Dixon and did so well that she considered that year in mathematics to be a 12 out of 12 on her chart. (Figure I)

> In ninth grade it [her confidence in doing mathematics] went up even more, up to a twelve. I had Algebra I. I was very successful with Algebra I. I loved it. In the first six weeks I pulled up my grade from a C to an A. And I believe I had a C because anytime I have been faced with a challenge in math from the fifth grade I kind of doubted myself and once I really saw how wonderful I could do in Algebra, I continued to soar. (Int. 3, L. 51-55).

Laura seemed surprised that she would do so well in algebra, but I had noticed her strong algebra skills during our tutoring sessions.

As a sophomore, Laura decided to take Algebra II and Geometry in the same year. "I did that so I could be on the fast track to get my math out of the way" (Int. 1, L. 349-350). However, over the course of our three conversations, that seemed to be only partially true. Struggles with geometry class were balanced as Ms. Sutton's support and Laura's strengths from Algebra I combined to make her feel successful in Algebra II.

> But Ms. Sutton in Algebra II really made me soar. She looks kind of like a blond bumble bee because she has that pleasant personality. She took notes on the board, and we had several examples. She also tutored me before, during and after class, whenever I needed her. She told me that I was one of the smartest women that she'd ever met that knew mathematics. That made me feel great, and I adopted her system of taking notes and often tutoring children in my own classroom. She always allowed me just to find my way in that class. I never felt like a guy beside of me was any better than I was. She always encouraged me to find out what I was interested in. For example she would give me assignments. If I was interested in finding out the quadratic formula, then she would do a special project for me that allowed me to develop my interest. She always told me that I could do anything, and she believed in me. I'm so thankful for her and what she taught me. (Int.1, L. 356-368)

Laura often mentioned Ms. Sutton because of her encouragement, not just in Algebra II, but in all her high school mathematics classes.

> And some of my teachers, like Ms. Sutton, who had a wonderful attitude, she tried her best. She had very high expectations for us, and you could see that in her ability to teach math. She was always the type of teacher that would be up around the room, and if I didn't know any better, I'd think she was on Prozac or Ritalin or something. But her attitude for learning was just what she commanded; she commanded the content of her knowledge; she commanded our attention. She was really all over the place, and she helped us so when she was positive and her environment was conducive for learning and I really enjoyed that. (Int. 3, L. 123-131)

Laura's initial memory of geometry class, also taken in her sophomore year, was only mildly troublesome. "Geometry was not my favorite subject that year, but I learned more about the theories and postulates and all that good stuff" (Int. 1, L. 340-341). Ms. Dixon, her algebra teacher from her freshman year made a disturbing assessment of Laura's abilities. Laura remembered:

> Ms. Dixon, she taught me geometry. I didn't understand it, and she told me that I never would because I was too bright to figure out geometry. She said my brain worked where I thought things that were easy, I made them very complicated and complicated things I made easy. She was right because I never did get the theories and if opposite angles were congruent then blah, blah, blah. I never got that. (Int.1, 351-355).

When I asked if she would recommend taking two mathematics courses in the same year, she said she would, but agreed with Ms. Dixon's assessment about geometry, that she just didn't have the brains for it:

> I definitely would [take two high school math courses in the same year]. I'm a person that will try anything once, and I think it really allows you to see your strengths and your weaknesses. For example, in algebra, I could do the formulas; I could do the pencil/paper, but on the other side when I took Geometry I really had to have an analytical side that I don't think I had. I think that by taking those two simultaneously I was able to develop a little bit more analytical skills. (Int. 2, L. 582-587)

When I heard Laura's assessment of her own geometry capabilities mimicking that of Ms. Dixon's opinion, I asked her if that assessment was accurate. She answered:

> Maybe, maybe not. I definitely didn't have a brain for thinking that way because, of course, I didn't have analytical skills. But I don't think a teacher should have put it in those terms. I think they should have developed my skills more and encouraged me and tried to help me with my confidence more instead of putting me down. Because maybe when they put me down that kind of made me freeze up inside and not be able to do it. (Int. 2, L. 596-601)

Laura's later decision not to take calculus in the 12$^{th}$ grade may have been influenced by her troublesome year in geometry. She considered the influences on her decision:

> I definitely think looking back, if I would have had a after school tutoring club or more help, I definitely think I might have been a little bit more encouraged to go on for the calculus, but I honestly believe that I had set up this glamorous hope that I was going to be so successful in geometry and then when I didn't, I was disappointed. I didn't want to be disappointed anymore. (Int. 2, L. 845-849)

Ms. Sutton, her second-year algebra teacher, offered to help her with her geometry; but Laura doesn't remember any getting any support from Ms. Dixon, the geometry teacher.

> [Ms. Sutton] really tried to help me. She did in her own way try to teach me strategies for Geometry and she did try to say, "Well have you tried thinking about it this way?" (Int. 2, L. 861-863)

Laura then began to consider why she didn't receive geometry help from her geometry teacher.

> Ms. Dixon was my teacher. Ms. Sutton was my algebra teacher. She would step in but Ms. Dixon didn't. Ms. Dixon was from the old school. If you weren't rich and you weren't a football player, or if you weren't white, then she wasn't going to help you. (Int. 2, L, 872-875)

> Football players would be out all night, could be out all night, and not take a test. That's fine. They would still make A's and B's in her class. People like me that would struggle and try would always make D's. (Int. 2, L. 879-881)

Another explanation, in Laura's view, for her struggles in geometry class might have been a lack of content knowledge on the part of Ms. Dixon.

> I think that's why Ms. Dixon really couldn't teach me geometry because maybe her content wasn't where it needed to be. She might have had a shaky foundation and she knew enough for her to understand it but she might not have known how to differentiate the instruction for all of her students. (Int. 3, L. 136-139)

> I was definitely surprised [that I didn't succeed in geometry] because I thought I had the same teacher; I did very well in Algebra I; I'm a hard worker. I'll treat geometry as a challenge; I can do this. When she told me that [that I didn't have the analytical mind for geometry] and after she told me that, the rest of the year my grades fell, the rest of the year. I think it's very interesting that I had the same teacher but different results, and I had a lot of confidence and hopes for geometry. Honestly, again, it might have been that she had more of a content based knowledge for Algebra rather than geometry. Maybe that made the difference. (Int. 3, L. 146-152)

Wondering about Laura's experiences with geometry topics, I asked her if she had covered geometry in that 5$^{th}$ grade year. She answered, "Definitely because we had a unit on geometry. We had a unit on geometry with circles, parallelograms and rhombus and things like that" (Int. 3, L. 158-159). She also remembered having geometry topics in middle school. "I had it sixth, seventh, and eighth grade. I had geometry sixth, seventh, and eighth grade. Not too much in depth as in tenth grade, but I did have topics of geometry through middle school" (Int. 3, L. 163-165). When I asked her if she ever felt confident with those topics in the other grades, she answered emphatically, "I never did. Never did. Never did." (Int. 3, L, 169)

Laura then reflected upon the reasons for her lack of understanding of geometry topics in earlier grades.

> I think it was going back to fifth grade and the year that I lost my confidence, and I shut down. I really believe that, every time that something reminded me of that fifth grade year appeared in my class work, I immediately got a block and I was like, "You know, I can't do it. I can't do it because I couldn't do it then, I can't do it now. There's no way." I remember I was doing geometry, we would have to do rhombus and things like that, and I would cry. I did not want to do it. I would cry when I did my homework, and I just really got defiant towards learning it. My parents at home were trying to help me with it, and if they taught me, I would be fine but as soon as I got to the classroom and I had to take a test on it, that was when I didn't know. (Int. 3, L. 173-182)

Laura remembered teaching strategies from her mathematics classes:

> I was never shown a manipulative on how to do geometry. It was either they would draw a circle on the board, they would make us follow along in the book, but there was no actual representation of a manipulative or a geoboard in place and actually that might have been good for me if I'd had a visual model to kind of help with my learning. (I. 3, L. 178-191)

We then recalled that during our Praxis I tutoring sessions, she had caught on very quickly to the geometry concepts when given physical models to work from.

Laura's assessment of her 10th grade year in mathematics represented opposite ends of the spectrum, as she explained by using her chart (Figure 1).

> In tenth grade, unfortunately, it dropped significantly from a twelve to about a two. I had geometry, and I made D's in geometry. I ended up with a C, by the grace of God, for my final average. My teacher took the approach that if I'm this smart; I should probably figure this out on my own. She wasn't really available to help me, and we really didn't have a lot of after school opportunities for remedial help. Had I had more remedial opportunities and a more supportive teacher I think it would have been better. In tenth grade I also had Ms. Sutton for Algebra II and I believe that if I would have had Ms. Sutton for Geometry that maybe I would have done even better. From tenth to eleventh, I did gain a lot simply because of Ms. Sutton and her wonderful way of teaching and offering remedial help. (Int. 3, L. 55-65)

Laura's 11th grade year was her last high school mathematics course, Advanced Mathematics. Although her teacher had a somewhat unorthodox teaching style, she succeeded in this class, perhaps due to her competitive nature.

> In eleventh grade I met Mr. Roberts, and he changed my life. For once he showed me that it didn't matter if I was a woman or if I was a woman of color, I was a person and I had gifts and talents just like anybody else. In Advanced Math, he would seat us from having the highest test grades to the lowest test grades and if you were in the lowest test grades, he would put you in the trenches. Needless to say, I was in the trenches a few times but he was my cheerleader, and he encouraged me to keep going and surprisingly I went from the last seat on one test to the first seat and I was really, really excited! (Int. 3, L. 65-73)

> That's why if it hadn't been for Ms. Sutton and Mr. Roberts, …. I don't know what I would have done. He didn't care if you were green, if you're a woman, boy, girl, he taught everybody. We had a respect for him. He would smoke a cigarette; he didn't care. He would use profanity in class, and he used to seat you from the highest test score to the lowest and if you were in the trenches he was like a cheerleader pushing you out of the trenches. (Int.1, L. 545-550).

Despite her success in Advanced Mathematics, Laura would not agree to take calculus in the 12th grade. She recalled the teacher who encouraged her to take calculus:

> Mr. Roberts, my Advanced Math teacher [encouraged me]. I had made A's and B's all year long and he asked if I was going to take calculus and I said, "No," I said, "I can't do it." He said, "Why not?" and I said, "I can't do it." From then on he would talk to me every now and again and I'd say, "Maybe it's too hard for me." He said, "Nothing is too hard unless you put a roadblock in your own path." But I never took it. (Int. 2, L. 783-788).

> In eleventh grade I decided that I would not pursue calculus despite Mr. Robert's abilities to persuade me that I was ready and I could do it. I didn't feel like I had the confidence to do it, so I did not take calculus in twelfth grade. The reason why I took two maths in tenth grade was so that I could have been on the five year math program. (Int. 3, 73-77)

When I asked Laura what it would have taken for her to sign up for 12th grade calculus, she promptly answered, "A miracle" (Int. 2, L. 793). Perhaps she was hearing discouraging voices from the past along with a negative assessment of her own abilities.

> Going back to tenth grade with that statement and always being put down for asking questions in class I figured you know what I'll probably have a lot of questions to ask and they're probably not going to be answered so what's the point? …Mr. Roberts was going to be teaching it, and I felt very comfortable with him. But still I didn't want to take the risk. I guess I was just afraid of not succeeding. (Int. 2, L. 797-800, 804-806).

Laura continued to connect her choice to forgo calculus with her experience in geometry.

> I guess because too I'm a perfectionist. I'm so hard on myself if I don't get everything in that class then I think I'm not going to learn and of course I made D's in Geometry. I made D's and that was like a shocker for me because I was always Ms. Honor Roll and I made D's and I felt really dumb because I honestly thought that D stood for dumb. (Int. 2, L. 811-815)

> I definitely think looking back if I would have had a after school tutoring club or more help I definitely think I might have been a little bit more encouraged to go on for the Calculus but I honestly believe that I had set up this glamorous hope that I was going to be so successful in Geometry and then when I didn't, I was disappointed. I didn't want to be disappointed anymore. (Int.2, L. 845-849).

Although as far back as middle school, Laura may have thought of taking mathematics every year in high school, she changed her thinking after her 10th grade year. But to compensate and continue to pursue challenges, she signed up for a physics class. She explained:

> In twelfth grade I did not take any math, but I did take physics with Mr. Ryan… I would probably say we had a lot of math skills in physics because we learned about force and torque and all of that…He did not show us how to do anything that year. We worked out

> of a …college textbook, and he was very mean, and he gave us pop quizzes all the time, and he sort of relied on our own natural innate ability to do physics or not. Surprisingly I ended up with a B in Physics. I guess I had that natural innate ability after all and he made me see that. (Int. 3, L. 78-85)

Looking back on her high school years, Laura thought she may have taken more mathematics classes, so it would have helped her on standardized tests such SAT and Praxis I. Nevertheless, her mathematics background seemed to be adequate for success at college.

*College Mathematics*

Laura recalled taking a test to determine her mathematics course as a college freshman. She never felt like she was a good test taker, and that her class work was more of an indicator of what she could do. In the case of her college placement test for mathematics, that was true. She recalled:

> I remember that I took the test prior to coming to college… and what happened was, we had all met together, I think, if I'm not mistaken, the math teachers had gotten together based upon my SAT scores, which was the pits in math, despite my strong math history, they decided and his name, Mr. Powers, decided that I should be in Developmental Math, but he was trying to make everything seem like it would be O.K. I'd just have to get our math skills up and then we'd get into Algebra. Knowing Laura, which I know myself very well, I didn't want even think about being in Developmental Math because why waste a semester of math? So I did talk with him about the courses I had taken in high school and so it was determined that there was an opportunity where you could take a test to get tested out of Developmental Math and I did. I scored very high on it. I don't remember what the score was, but I did score very high and he was surprised himself at how much I knew. And as a result I made A's in College Algebra. I was very successful in College Algebra. I absolutely loved it. So I was very successful. (Int. 3, 593-408)

Laura only took College Algebra, which, at that time, was all that was required. She mused that teacher education students need more mathematics classes, and I told her that now preservice elementary teachers are required to have 12 hours of mathematics.

*Praxis I- Mathematics*

Laura's final brush with mathematics in college came with a new competency test requirement for those seeking teacher licensure, *Praxis I*. She remembered back to the first time she took the test.

> The first time I took the test I had heard a lot of people talking about how hard it was, and I knew you couldn't get into any programs at the college unless you passed the test. …Of course it was a test so I was already just terrified, I just knew it was a test that was going to ruin my life, and it did for two years. It ruined my life. I went there the first time, opened the doors, got out of the car, went right up and gave the woman my ID pass with a shaky hand, I sniffled and cried before I took the test and I continued to sniffle and sob throughout the test, and I was fortunate that I sat in the back of the room so no one

> could really notice it was me. But I just knew that I was not going to be able to pass this test and my dream of becoming a teacher was going to be ruined. (Int. 2, L. 692-701)
>
> I didn't have an expectation of passing at all. I didn't think I would. (Int. 2, L. 705)
>
> After I got my scores that said I failed, didn't have a chance. I said, "Nope, I won't pass it again and what will probably happen is that I'll have to change my major and I'll have to go back and do something different because maybe I'm not supposed to be a teacher, maybe this test is just showing me that I'm not supposed to be a teacher." (Int. 2, L. 709-713)

Laura continued to take the test, but was not successful in meeting the minimum score.

> After about the sixth time. I finally had to push past my preconceived ideas, I had push past that and I said, I told myself I have the choice either I can let this test beat me. Or I can beat this test, so I decided that I would try and go and find things to help me prepare. The test books, the study guides that went with the test, were not helpful. Again because I think it was in a standardized format and I don't do well with formats like that. Fortunately you came along and I talked with you about my problems and my concerns and my situations and you offered to help me. (Int. 2, 717-724)

Laura and I worked together from a middle school mathematics textbook to review all the mathematics concepts. Although her algebra skills were strong, her arithmetic concepts were weak and word problems, which made up the majority of the Praxis I test, were difficult for her. After hours of study and determination, she made the minimum score on the test on the 11th attempt.

*Reflections as an African American*

Many areas of Central Appalachia are predominantly white, and so was the town where Laura grew up. Remembering her fifth grade class, she calculated:

> If I'm not mistaken, the class make-up was predominantly Caucasians, of course because it is Appalachia. And I believe there were three of us African American students in the class, and if I'm not mistaken, it was probably equal in terms of girls and boys. (Int. 2, L 122-125)

She was in high school, however, before she, as a student, realized that some teachers treated her differently because of her race. Laura explained:

> The first encounter that I ever encountered of really knowing that I was the black person occurred while I was at Parnell High School. I guess that I always knew that I was a black person, but it really didn't make a difference to any of my teachers before, until I got to high school. I guess they thought that, you know, she's on the college track, and she could be a threat. I really don't know. But I had teachers that did not like me because of the color of my skin. They treated me horribly just because of that and to me as an educator, I don't think that we should treat students any different because of who they are. We all

> have prejudices against something. Maybe I'm prejudiced against broccoli or carrots or whatever, but I don't think that as an educator you should ever not like a child because of the color of their skin. If so, you're in the wrong profession. (Int. 1, L. 383-393)

Laura, a part of a small racial minority in the school, was the only African American in the high school Advanced Placement (AP) classes, as well as in the gifted classes.

> I was the only black person in my class. From ninth through twelfth grade if there were honor courses I was the only black person in the honor courses. (Int. 1, L. 398-399)

> I was the only black person in the gifted program in elementary school. I was the only black gifted person in middle school. When it came to AP courses in high school I was the only black person. So I always had the feeling of there's nobody in this room that looks like me. (Int. 1, L. 403-406).

In AP History class, Laura explained how she felt discriminated against:

> Going through Parnell High School, I felt like I had a challenge because of the color of my skin. I had a teacher that would not give me the grades I earned because of the color of my skin. If I had to do an AP History assignment it was always on slavery or some other demeaning form of being a black person. (Int. 1, L. 374-378).

> Looking back I can honestly see how they [teachers who were prejudiced] can honestly subtly devalue and degrade you as a person. For instance when you're the only black person in AP History and you're given topics of slavery all the time or when a course document is read about slavery and anything that pertains to black people, and you feel like everybody is looking at you it's really a painful situation or the idea of never seeing anybody that looked like you, you begin to wonder, "What's wrong with me? Why is there no one else that looks like me?" (Int. 3, L. 268-274)

In addition, almost none of the faculty members were African American. "I've only had, in my lifetime from kindergarten through twelfth grade, I only had three black teachers" (Int. 1, L. 413-414).

Laura's memories of the different groups of students at the high school involved a social class structure:

> If you were what they called trailer park trash, and they would call students white trash, they were also put in with the black children because you know they were white, but still they were on the lowest part of the totem pole. So black people and people who lived in trailer parks, they were on equal footing here. That's the idea that I've gotten and when I was in school, surprisingly enough, I had friends from the upper crust down to the lower and I always felt like I identified more with the lower crust people. (I. 3, L. 343-400)

We discussed her position of being the only black student in class with only one black teacher at the high school level and how this may have affected the ways that people reacted to her.

> They might not have realized it because based upon the way they grew up it could have been ingrained but definitely with the other teachers that I can look back and see some of the kids were actually more standoffish. (Int. 3, L. 288-291)

Thinking about this topic brought to mind an example of how being African American made her very different from her friends. Laura sadly remembered:

> Like there's a time there was a birthday party, birthday party invitations were being passed out in my class. I didn't get one because I'm not allowed to swim in the country club's swimming pool or the Golden Heights pool, that's just not something you do. You don't invite a black person to swim there and I was not invited. It really hurt my feelings because that was one of the few times in high school that I realized I wasn't like anybody else. (Int. 3, L. 291-297)

> It's very painful. Just thinking about being there and everybody talking about a good time that they had and you didn't go. (Int. 3, L. 301-32).

In addition to what Laura remembers as prejudiced actions in this course and among her classmates, she encountered other types of unfair treatment. She remembered, "My guidance counselor was also like that. She told me that I should go to another college beside [a large state university] because 'people like me' didn't do those things." (Int. 1, L. 432-434).

Laura described how she was denied her rightful place in the class standings due to intentional actions by members of the school administration:

> My GPA was altered to my surprise. I had applied to some colleges for scholarships and upon calling and not receiving the financial aid I thought I was going to get. My father had a stroke my senior year of high school so which made it difficult [for me] to attend college. It just wasn't possible. The only places that I could go to school were the places that would pay for me to go full because, as much as my parents wanted to send me, they just couldn't do it. So when I didn't get as much financial aid from a school as I wanted to, I looked at my GPA [Grade Point Average],and she had incorrectly put my GPA down as a 3.47 when I actually had over a 3.7 GPA. (Int. 1, L. 434-443)

> I hold the guidance counselor responsible. But of course looking back now that I'm older and I guess at that time when you're younger, you're naive and you think that everybody that's a teacher is supposed to be there for you. I really think that the school should have a checks and balances system where if you earn a certain GPA then it should be accounted for. I don't think that a person with that much power, they can determine whether or not you can get into a school. (Int.1, L. 453-460)

> It was deliberate. There was a meeting held to discuss the top ten in the graduating class at Parnell High School ... My parents and I did not find out about that meeting until way after I had graduated. The people in the top ten had not taken as many AP courses that I had taken but they were hand picked by the guidance counselor, and I had a teacher who no longer works there because she knew and in good faith she could not continue to teach there**.** (Int. 1, L. 464-469).

The one who found the inequities intolerable was Laura's Algebra II teacher, Ms. Sutton. Laura recalled, "She left because they did not like her, because she helped black children. They would call her a nigger lover." (Int. 1, L. 474-475) But Laura had a chance to talk to Ms. Sutton in later years and gained additional insights:

> She never told me all these things that were happening to her until she and I met for breakfast one year after I came back from graduate school. She never told me. I am just grateful for her doing that for me because, at Parnell High School, you knew as a black person that you were not wanted there. Certain teachers would just treat you differently, and I really don't know how you can put it into words. It's just that feeling I can recall getting. Just that feeling of, "Well because you're black, you know, you're not good enough." (Int. 1, L. 501-507)

Despite incidents of individual and institutional racism at the high school, Laura managed to gain success in grades as well as in other ways. She described her overall impression of her high school years:

> … that's why I was so fortunate that I had some teachers at Parnell High School (PHS), not saying that they all were bad, but I had a few good teachers that made my life worthwhile. It made me continue to want to learn. If I hadn't had those two good teachers [Ms. Sutton from Algebra II and Mr. Roberts from 11th grade Advanced Mathematics] I probably wouldn't have made it because by the time I graduated: Number one I made a first at PHS, I was the first black Miss PHS my senior year, and I was the mayor of the student government thing, and it was just amazing. I believe that God put me through that experience to test me because when I left PHS Laura had arrived. I knew exactly who I was, I had grown in my skin, going through all those painful moments, I knew who I was and I knew if I could survive that, I could survive anything. (Int. 1, L. 555-564)

Laura did not recall being aware of prejudicial treatment when she was a middle school student. However, from an adult viewpoint, she considered her placement in mathematics to be a form of prejudicial tracking:

> Based upon, again trying to group all of the children. I guess they were trying to group all of the children together because if I recall correctly in middle school every ability level was grouped together so all of us average group kids were together, all of your higher kids were grouped together and all of the low were grouped together. (Int. 2, L. 344-348)

> It [the fifth grade mathematics placement test] determined your track in middle school and I definitely believe it was tracking. Looking back I guess I didn't have the educational jargon that I have now but it was definitely tracking because I think back to seventh grade with Ms. Carter, and I was grouped in the average group. Some of the things that she taught me after I learned it, it was way too easy but I was in this tracking system so I couldn't go anywhere. (Int. 2, L. 352-357)

> I think that tracking, and I guess too it goes back to our area and our high rates of poverty, I honestly believe that because there were a lot of children that were poor that they didn't expect them to amount to anything. For the wealthy children, they expected them to just be it all. For me, I was middle class so I was stuck in the middle but then looking back now that I'm older, I didn't realize it then, but now that I sit here and talk with you, they probably didn't have much hope for me as an African American person either. (Int. 2, L. 366-372)

Laura remembered other activities in elementary school which, in retrospect, seemed to be divided along class and racial lines:

> But the same children, usually they were white children, mostly males with money [would be picked to participate in extra activities] and the rest of us girls or African Americans, we really didn't fit in. (Int. 2, L. 116-118)

After experiencing overt and subtle incidences of racism in public school, Laura was concerned about attending a predominantly white college. However, she found that at the college, she was given encouragement by faculty members. She recalled:

> So, when I went to college I was kind of shaky at first. When I went to college because it was a predominantly white school and based upon my experiences at PHS I didn't really know how I would be treated. I really did not know how I would be treated and so again I got in [an] …Honors English class and I met wonderful professors there. (Int. 1, L. 565-569)

After graduating from college, she attended a large state university to work on her master's degree in curriculum and instruction. The size of that institution and the diversity of the student body worked to greatly increase feelings of equity in terms of race. Laura reported, "When I went to the [university] it didn't matter. It did not matter because there were so many nationalities no one ever looked at me as being black or African American." (Int. 3, L. 349-351) Laura completed requirements for a master's degree and is understandably proud of her accomplishments.

*Reflections as an Appalachian*

Unfortunately, the university that seemed so magnanimous in regards to racial views housed stereotypical images of Appalachia. Laura recalled one class in which a bias against the region was quite openly expressed:

> When I went to [the university], oh my goodness, they made me feel like [Laura's home town] was the ending point of Virginia. I had a professor stand up in the middle of class that said that nobody from Appalachia could ever teach any of her children because they're a bunch of hicks. And I stood up and I said, "So that means that I can't teach your child?" It was a class of about 7 of us and this is like our second class meeting, and she tried to be so apologetic throughout the whole time. A lot of people had this mindset, especially at [the university]. I called them snobs because they were not very friendly, and I felt like they got nose cramps from being so snobby. (Int. 1, L. 823-831)

> [The university] is the place that I really saw where I come from was problematic for some people to understand because people were very surprised that someone like me, from Appalachia, with a southern twang, could be intelligent enough to come to [the university]. You know, we're supposed to be on four-wheelers and drinking moonshine and acting crazy. (Int. 1, L. 836-840)

> I think my Appalachia [background] probably appeared more [than the African American heritage] because at [the university] there were more people that were of all nationalities, so it was like a melting pot. I don't think it really made a difference. I think my whole contention was the Appalachia [background] and trying to prove myself that, "Look, I'm from Appalachia" and I really felt like it was my duty to dispel the myth they have of us. (Int. 1, L. 845-849)

So at the university, Laura traded negative reactions to herself for being African American in for negative reactions as a result of her Appalachian heritage.

In regards to public schooling, Laura speculated at what age she may have realized that she was from Appalachia:

> You know I don't think that I ever realized [growing up] that I lived in Appalachia. I just knew that I lived in Virginia in a little place called Meadowtown. It wasn't until I had some teachers like in middle school that showed me on a map where my region of the world was. But even then, I just thought that I was in a place just as big as New York City. It didn't matter to me. (Int. 1, L. 861-865)

She recalled in eighth grade, a teacher making reference to Appalachia as a place juxtaposed with "the city":

> I loved that [science] class because [the teacher] encouraged us to use our creative thinking side. She told us that just because you're from a small place like Appalachia does not mean that you cannot do things that people in the big cities do. I was like, "Wow! You know, I can do it!" Before, I used to think that "I just live in this small place and there's not a world outside of that." (Int. 1, L. 287-292)

Then in ninth grade, she remembered making a new friend who came from "the city" and who taught her a little about the differences:

> I also met a friend named Clarissa Foster who was from the city. Clarissa was a city girl, and I was a country girl. But she showed me the ropes because she really made me want to see the world outside of Meadowtown. I think that she put a little seed in my mind to show me that there is something else outside of Meadowtown. She told me about all of the nice things that she did and places that she had visited. (Int. 1, L. 309-314).

Even though her family had taken vacations regularly, comparing life in the "city" and the "country" did not occur until high school.

A concept closely connected to Appalachia is poverty, and as a child Laura had been aware of class differences in elementary school and to notice children who were obviously poor:

> Economic level in my class was probably more ritzy, wealthy children and then it was a few middle class, I was fortunate to be in middle class, and then the rest of them was really low in poverty. (Int. 2, 129-131)

> I would say it probably didn't register until about fourth grade. For instance, when we had like classroom parties and Valentine's Day and all of that good stuff, when you have a basket yourself that was nice and shiny and new and you look around and see the person next to you and their box is tattered and torn you kind of wonder, what's the difference? I actually went home and I would ask my mom things, "How come my tennis shoes are clean and hers are dirty?" My mom would kind of allude to the fact that some children are not as fortunate as you are and she explained it in a way that I could understand it because again, from our last interview, both of my parents grew up in poverty. So I guess that she kind of understood how that felt and if I would go home and I would be really concerned, like we were having a party, I'd be really concerned that there wouldn't be enough Valentine's Day cards for my friends, she would always make sure she bought an extra box**.** (Int. 2, L. 143-160)

She remembered one little girl in particular:

> We had doctors' children; we had middle class; we had poor children. I had a friend of mine named Margaret who was abused. I met Margaret when I was in fourth grade, and Margaret came from a little children's orphanage… and it's now a church. She was placed there because of abuse in her home. I met her in fourth grade and she was really poor. (Int. 1, L. 897-902)

> So when I met Margaret, she never had ice cream money and her hair was always matted and dirty. I asked my mom one day, I said, "Mom, I have a friend in my class that I would like to share ice cream money with." And I asked her if I needed to take it out of my allowance and she said I should but if I was trying to help somebody, no, and she gave me an extra fifty cents for ice cream. Margaret was my buddy until they took her away one day after school and we were playing on the play ground and after that I never saw her again. (Int.1, L. 918-924).

> [The other children] didn't like her and they would call her names. They would say she smelled. They would tease her and she was the last one picked for games. My parents always told us to make friends with people and it seems like I always got paired up with the kids that were hurting the most. I guess that was just my personality that I wanted to help people because at Christmas if there was an unfortunate family I always volunteered to give away one of my new toys. I didn't feel right playing with my new toys knowing that somebody didn't have any. (Int. 1, L. 922-934)

From her observations of class differences in elementary school, Laura reflected on how those designations affected her as an African American:

> …certain children wouldn't play with certain children. If you were from a trailer park you didn't play with children from [certain part of town] or if you were an African American child some white children didn't want to play with you because of the color of your skin. As a young child growing up in Appalachia where there were only two cultures, black or white, it can be kind of sad at times but I do remember with me, I would play with all the children. I never ever made a point to play with only certain children because they lived in a certain home or they had a certain amount of money. I played with all children because that's the way I was taught but I definitely believe that what children do is a result of their upbringing at home and that their parents are the ones that are responsible for that. (Int.2, L. 162-172)

Laura's identification with the poorer children seemed to have a basis in her belief system as well as class stratification imposed by society.

From her viewpoint as a teacher, Laura considered the impact of the Appalachian culture on her experiences as a student in public school:

> I think a lot of it [Appalachian culture] played into it [the school system] because if you constantly are in an area that has certain ideas and certain beliefs they become a part of who you are and I honestly believe that. I honestly believe that because traditionally Appalachian culture does not have that high emphasis compared to other parts of the world for education and for character traits and things like that. I really guess that it became truth for them. (Int. 3, L. 243-249)

> It was like a dividing line you know. You have to respect your teachers. That was ingrained in you from day one and you have to respect them but at the same time I was confused because how can I respect somebody who really doesn't like me. That was hard for me because I was thinking, "I have to respect this teacher but then again how can I respect the teachers that are awful?" (Int.1, L. 952-957)

> That's right. I did, I respected all of my other teachers except when I got to the high school even the ones that weren't so nice, I still had the respect because we're taught early on: you have to respect your elders, you have to respect the adults because you are a child and you stay in your place. They're older than you and they know more about life than you do so you have to respect people. In my home it was always, "Yes ma'am", "No ma'am", "Yes sir", "No sir", "Please" and "Thank you". We were always taught manners at the dinner table. One of the best ways to get your dessert taken away was to put your elbows on the table and say "yeah". That's just the way it was and so in school we never really had a lot of discipline problems because we understood the teacher was the central authority figure in the room and we had to respect her. (Int. 1, L. 962-973)

The idea of respect for the teacher created a conflict for Laura. "…it was hard for me because I felt like my faith had been shaken in the whole respect system. I didn't understand why should I respect teachers that don't respect me." (Int. 1, L. 978-980)

From a teacher's viewpoint, Laura reflected about how holding the classroom teacher in high esteem could lead to a misuse of that authority:

> In Appalachian culture we're taught early on that the teacher, you have to respect the teacher. And if a teacher is doing something wrong, you don't dare go against her and in my high school years the teachers did have an abusive power because some of the teachers were obviously, very blatantly prejudiced against people of color. They did have abusive power because they put you in a position where as if you question authority you're grades would be cut, you would pretty much be an outcast. They knew if we wanted to go out of Appalachia, we had to have an education and so their abusive power definitely out weighed anything you had to say. They almost devalued you as a person. (I. 3, L. 258-267).

With her education and teaching experience, Laura struggled to think of a way in which problems, like racial prejudice from teachers, could be solved. She contemplated:

> I think they [teachers] need to go back to school and they need to do some research. And I think they need to really look within and figure out why they have these issues. It's O.K. if you don't like everything or everybody but you should respect everybody and if you have these tendencies you need to step outside of the classroom if it's that strong for you. I really think in somewhere like Appalachia where there's only two races, black and white, we need to have more things that will open up people's eyes. To look at more cultures than just black and white because when children leave Appalachia it can be a scary experience when they see all of these other cultures.
>
> It was for me, and I really think that multiculturalism starts early on because there's not enough multicultural teachers. There's not enough programs in schools. We need to implement programs from kindergarten through twelfth grade that really emphasize that because sometimes as teachers you have to be educated as well on things you don't know. I think they might have been the way they were toward me because they did not know who I was but their feelings that they had toward me because of the color of my skin sort of made them back off and not want to know. (Int. 1, L. 985-1001)

Not being given the chance to participate in the advanced mathematics track in middle school, Laura expressed her views on that practice:

> I definitely think now, as an educator, that you shouldn't homogenize education anymore. I think you need to mix it up because children are going to have to work with children of all different economic statuses and backgrounds. I think that education should have been education for all, not just education for some. (Int. 2, L. 390-394)

> But I think, because we are in Appalachia, we need to start looking at some of these bigger surrounding cities to compare our education to so that our children will be able to compete and be prepared for what lies ahead. If we only put children that are poor in low achieving classes and children that are wealthy in high achieving classes then we're doing a great injustice. (Int. 2, L. 399-405)

Now, from the viewpoint of a well-educated teacher, Laura felt she could more honestly assess the practices she encountered in the public schools of Appalachia.

*Laura's Recognition of Her Parents*

> Appalachia is a great place. It's a place where you learn family values. It's a place where you learn that life is not measured simply by the amount of money you have in your pocket but by the love that you have in your heart for people and for God and just having this undivided attention to and respect for teachers and people who are in charge. I think that my values that I learned in Appalachia make me a better adult. The Appalachian culture, if I could use a word, I think I would describe it as family because definitely they do take a village to raise a child. We don't have a lot so what we do have we value. (Int. 1, L. 850-857)

Laura's general description of Appalachia was a favorable one, but the emphasis on family was an indicator of the tremendous impact her parents had in her development as a strong, tenacious, caring individual.

Both of Laura's parents grew up within 35 miles of their home, and their experiences with poverty and with racial segregation resulted in a tremendous strength, courage, and compassion that they sought to impress upon Laura and her older brother.

> Both of them grew up during segregation times. My father-- he graduated as valedictorian of [an all-black high school], and my mother finished pretty high herself. She graduated from [a high school in a neighboring county], and both of my parents were born early, extremely early to teenage mothers. They were never put on welfare; their grandmothers and grandfathers helped to raise them, and they were very poor.
>
> My father only had one pair of shoes, so did my mom. My mom and dad both wore hand-me-downs. There were times that the only way that they ate on Saturdays was if my grandmother would clean for white people on my dad's side or on my mother's side, my grandfather would clean at a local store and whatever meat was left over he brought home to feed the family. (Int. 3, L. 407-417)

> Well, like when they were growing up they had to wear hand-me-downs and both my grandparents would clean for people to have money and they grew up really poor. They didn't have shoes a lot of times. My mom would get one pair of shoes that would have to last her the whole year, and she had an aunt who lived in New York that would go to a place to get them clothes and send them back to where they lived. They didn't have running water. They never did have a bike of their own. (Int. 1, L. 878 -884).

> So they were very poor but education was always something that was of valuable importance in their families. My grandmother, who's my mom's mom, she dropped out of school in like the seventh grade. She never ever finished school. She did attempt to go back and get her GED [General Equivalency Diploma], and she has a driver's license now. My father's mother she did get some schooling. She did finish school. It was very hard for her because my father was labeled by kids in the community, kids in the community would not play with him because his mom was so young when she had him. My mom was also picked on a lot because of her clothes. She didn't have a lot of clothes and kids would laugh at her. (Int. 3, L. 417- 426)

Growing up in poverty created sensitivity for the less fortunate, and Laura knew that story and recalled how her parents always related it to children that she came in contact with.

> If there was a child and people were teasing them…our parents would always remind us, "Well that was me and your mom, when we were growing up we didn't have a whole lot." Like my mom never really had a birthday party until I threw one for her 50th birthday party. Neither her or my father ever had a birthday party growing up because they just didn't have the money. They never had a birthday party. (Int. 1, L. 939-945)

As Laura, the teacher, encountered poor students in her classroom, her parents' teaching continued to influence her actions. She described two such students:

> And that's the thing, based upon those experiences. It really impacted the way I was raised because my parents carried that same trait over into us. Education is important. You don't treat anybody any differently; everybody is the same; you love everyone. You know education is the key to open up all of your doors and make all your dreams come true, and you have a strong faith and a strong work ethic.
>
> When I began to teach in my classroom little Rani; his family is from India. He always has chips and a drink in his lunch box. Based upon what my family went through as children I'm very sensitive to him. I'll buy his lunch. I'll make him a sandwich and put it in his desk so he has something extra to eat. If a child does not have lunch money that day I'll be more than happy to buy their lunch even if I don't have a lot of money which I don't because I'm a teacher, too.
>
> Then there's Leyla who needs a mom, and her hair is never combed. And I brush her hair and she has barrettes in her hair and she always looks clean when she goes. There's been times when I've bought children shoes for Christmas just because I want to be an advocate, and I really think the way my parents were treated. It carried over into me as a person and as a teacher because I treat all of my children the same. (Int. 3, L. 434-451)

In addition to the lessons from poverty, Laura's parents taught her about the realities of being racially different, while, at the same time, emphasizing the Christian ideals of love and faith.

> What can I say about my parents? They always told us that by being an African American person or a black person that we would have to prove ourselves to some people. And they didn't tell us that to be prejudiced against anyone, but they also prepared us for the real world. That some people were not going to love us just because we were wonderful people. (Int. 1, L. 778-782)

> My parents tried to tell me like it was. They said, "Laura, you know, we're different. Some people are not going to see past the color of your skin." It really just tore me apart because my dad explained to me, "Well this is how it was when I was growing up with you mom in segregation." And they said it's not right, people have their own opinions and you sure can't change them. (Int. 3, L. 306-310)

> In Appalachia all you know is two races: white and black. My parents they never ever said, "Well Laura, you know, you don't like white people or you don't like any group of people." They never said that. They always told us that you loved everybody for their heart, for their personality, for all of the wonderful characteristics that they were. (Int. 1, L. 787-791)

> I think it definitely was their Christian faith because both of my parents had a reason to develop a nasty attitude toward other people because they grew up during segregation times. I think their Christian faith really helped them to see the good in everybody. I was brought up in a Christian home, and my parents always encouraged us to love everybody. It didn't matter. If I would talk about a friend that I'd met in school, I was never allowed to say, "She's little white girl" or She's a little black girl". It was just, "I met a friend", because my mother always taught us that friends don't have colors they have names. (Int. 1, L. 795-803)

Partially as a response to the experiences of poverty and bias, Laura's parents strongly emphasized education. Laura noted, "I knew that I was always going to college" (Int. 1, L. 690). Both of them had college degrees; her father's was a B.S. with a double major in mathematics and biology. They used every opportunity to teach their children and to stress the opportunities that education would provide. Laura recalled that even family vacations involved an assignment:

> My family always took us on a vacation, but we had to do research papers and reports when we came back because my mom was always looking for a teachable moment. Everyday I had a new vocabulary word. Everyday from kindergarten on up, everyday I had a new vocabulary word I had to use in a sentence, I had to define it, I had to tell her what it meant. Everyday I had some type of stimulating exercise. Mom would always ask me a "what if" question about my learning. Like, "What if you didn't do it this way?" So when I went home to do homework, I could never get by. And she always told us that when we go on vacation it is a time for you to see different things, and it is also a time for you to gain knowledge. She would pound it in us everyday, from counting beans in the first grade and eating them to whatever. She would always use household items to teach us math and so before I went to kindergarten I could actually read and I could do my letters before I went to kindergarten. I could print my name and I knew my address before I went to kindergarten. (Int. 1, L. 315-328)

Laura's grandparents echoed the themes of learning even to her as a very young child. She remembered doing different kinds of mathematics with her grandmother:

> Like in pre school I can remember I would go to the grocery store with my grandmother and I can remember as young as five years old she would have a bag full of groceries and she would teach me how to put things into groups then…Sorting, counting. I would go to down in [a neighboring county], and I would spend summers there, and I would spend weekends there. My grandmother who helped raise my mother was older, and she cleaned houses for white people to feed my mother. We would go in the creek and wade, which I loved to do, and eat buttermilk and cornbread. We would count the ducks and

> she would be specific, she would say, “You know I never had an education but I want to teach you and your brother something.” (Int. 1, L. 757-772)

Laura’s parents surprisingly used discipline for “teachable moments,” and she explained how those lessons stayed with her.

> I mean if you misbehaved and you got a spanking, your pay was docked 50 percent. So throughout the time, they really took their lessons about not having money, and they put it on us, how to be thrifty. I’m the world’s best clearance shopper to this day. I’ve had a checkbook since I was sixteen. I’ve worked since I was sixteen. I worked full-time during college and full-time during my master’s program. It has given me a very strong work ethic because my parents never allowed us to take anything for granted. (Int. 1. L. 911-917)

Laura’s desire to get an education, and her parents’ support of that dream, proved to be an encouragement throughout difficult times in public school.

> I think that one of the best things that helped me to cope, to get through day to day activities, was my desire to get an education. I really think that I was a little wiser beyond my years, but I knew that I wanted to learn. Education was very important to me. My parents had instilled that in me from day one, and I believe that my mother, by telling me everyday that I was wonderful and beautiful and important and special, by her telling me that over and over and over it became truth. After a while, a little bit at a time, I felt a little bit better about myself and when I felt like I didn’t matter, I always remembered that my mom told me, “Remember you matter to me.” (Int. 2, L. 179-187)

> I looked at where I’m from, and I knew that my parents always told me that education was the key to open all doors. They told me that if I wanted to get out of Meadowtown, I had to have an education. I’ve always been the type of person that I’m not satisfied with just doing the minimal amount. I will push myself above and beyond. As a fifteen year old I think I must have been kind of mature because I always knew from day one, my parents always put the idea in my head that I was going to go to college. I guess I was kind of thinking about, “Well, if I want to be a teacher, I’m going to need certain skills.” (Int. 1, L. 678-685)

With the interest her parents had in her education, they were aware of the some of the problems Laura encountered in school. But Laura persuaded them not to talk to her teachers. She reminisced about their reaction to her disappointment in fifth grade about being denied the opportunity to take the placement test for upper level middle school mathematics:

> My parents were very saddened by that because they wanted me to be happy. They wanted me be a good learner and wanted me to enjoy school. They wanted to talk to my teacher, and I begged them not to because I thought she would not like me. I was terrified so they allowed me to suffer in silence. Sadly, but they let me suffer because that’s what I wanted and it was just awful because in fifth grade I just shut down. I did not want to learn anymore. I even forgot about wanting to become a teacher**.** (Int. 1, L. 131-137).

> My parents were very upset, of course, seeing that this was something I wanted and something that I had worked so hard for. It was almost like a punishment for me I guess. I went home and I told my mom about it and I asked her what I should do because I didn't want to make trouble for myself but at the same time I didn't want to put my ability in a box either. I talked to my mom and she was going to go and talk to the teacher but I begged her not to, so she didn't go talk to her…Now that I'm an adult, I should have definitely opened up my mouth and I should have demanded that my mother went and talked to that lady because maybe it would have enhanced my education during my middle school years in some kind of way. I really should have went and talked to her. (Int. 2, L. 89-102)

In high school, Laura had tested in to the Honors English class, but a scheduling conflict threatened to deny her that opportunity. This time she did not convince her parents to avoid a confrontation. She remembered:

> It [ability grouping used to deny opportunities] shows in high school simply because in high school, my parents pushed. I was tested to be in Honors courses from ninth to twelfth grade, but my parents pushed. I had strong advocates to push to get me in there because at one time my guidance counselor said, "Well you're in this spot. Laura has to take something else so she can't get into her Honors." My mom went to the school and made them change my schedule so I could have that Honors class. (Int. 3, 382-388)

Laura's parents acted as teachers, counselors, coaches, and role models. Their strength seemed to give her strength in the face of difficulties she encountered in public school. Their message of encouragement resonated throughout many times in her life: "They always told me that if you never experience an obstacle that you're never learning, so maybe I'm having learning opportunity after learning opportunity to grow" (Int. 3, L. 236-238).

*Final Thoughts*

Although Laura encountered difficulties in her years of public schooling in Appalachia, she triumphed over them by graduating from college and graduate school and obtaining a teaching license. Despite a severe setback when her father suffered a stroke during her senior year of high school, Laura's parents found a way for her to go to college. She expressed an understandable sense of pride:

> It makes me feel proud. It makes me feel like I've accomplished something, not only for myself, but for my family because my family has had a reason not to succeed based upon the economics of our family. Both of my parents grew up in poverty, but it made me proud because most women in my mother's family my age have children. They don't have a high school diploma. They don't have a college degree. They have minimal educations. (Int. 1, L. 737-742).

In reflecting about her educational opportunities, especially in mathematics, in Appalachia, Laura acknowledged the importance of her parents and some teachers and made recommendations for improvement:

> I definitely think that [living in rural Appalachia] affected both my math and my regular education in general because I had such strong advocates in my parents and some teachers. I did value education as something that was of uttermost importance in order to, I guess, escape the Appalachian poverty, the Appalachian mindset issues.
>
> In terms of math I believe that we need teachers that have a broader sense, not saying that we don't already have good math teachers here, but they need a broader sense of their content and they should be upheld even as much as I don't like the Praxis I think there should be another type of assessment where these teachers have to renew their credentials after so long. I know that they do that renewing of licensure but I'm talking about actual content because no one stays the same in their knowledge of a subject, even I don't.
>
> I've been teaching for three years, and there's definitely some things that I can brush up on. But I do think after so many years I think they've taught this same topic, used the same books for over and over and over and their content and their teaching methods did not change with the times. I definitely think we need to do something about that. (Int.3. L. 552-557)

At the end of the last interview and reflecting upon her disappointment and triumphs, with injustices and opportunities, Laura wanted to emphasize, as a final thought, a belief she highly values:

> … I think it's important in my story to realize that despite the prejudices that I have encountered I'm still not a prejudiced person and I don't judge all people based upon what happened to me. (Int. 3, L. 604-606).

After Laura had a chance to read the completed life story and verify it, I wrote to her and asked her how telling and reading her own school story had impacted her teaching. She mailed back a very detailed hand-written response:

> As I was reading through my own school story, many memories come to mind. I realized that certain memories affected the way I learned and impacted my academic growth. As a result, as a classroom teacher, I am attracted to those students who have similar learning styles and characteristics which resemble my own. For example, those students who are in economically challenged areas or students who have academic complexities. Last year, I had the opportunity to teach Rani. Rani, a student from India, was economically challenged. He was a cute brown-faced frail student who had eyes as bright as stars.
>
> Rani would very rarely speak out in math class with his broken English. I noticed he never raised his hand to volunteer an answer. However, he always had a "confused" look. As a child, I always had a "confused" look on my face especially during my middle school years. I simply didn't get it, and I was frustrated.
>
> I decided that I would find a way to help him learn. Reading through my story, I remembered some of the teachers that made math fun. I remembered some of the strategies that made me smile instead of having a confused look. I was ready to put my plan in action.

> We began a unit on multiplication and division. Knowing that Rani was a visual and hands-on learner, I gave him counters to figure out the answer. For example, if the problem was 4 x 2, Rani would take two groups of four and add them up. I knew he hungered for knowledge, but his language barrier and his economic status was a challenge. Slowly we worked up to one digit by one digit division, and he learned all of his math facts from 1 to 5. Rani passed his math [state assessment test] by one standard deviation point. I was pleased! Although Rani did not go onto the fifth grade, I am proud that I laid a foundation for him.
>
> I realize that as a teacher you have to be aware of all learning styles and put yourself in place of the student. I realized I was most successful when a teacher could identify with my needs. I hope and pray that as I continue to teach, I will be able to reach as many students as I can. (Personal Communication, July 20, 2005).

Laura experienced obstacles to learning in public such, yet she succeeded in her own educational accomplishments. In addition, those experiences provided a framework for her teaching and her desire to reach children who struggle with mathematics.

*Synopsis of Mathematics Learning in Appalachian Public Schools*

From the very first interview, Laura had given much thought to her public school years and was quite forthcoming in discussions of those experiences. From the interviews, the chart, and artifacts, constructing her life story throughout those years helped to shed light upon her experiences in learning mathematics. Having college educated parents who used every opportunity to teach her, Laura started school "ready to learn"[10] (H. R. 1804, 1994, Sec.2). Her shyness and speech problem, however, may have provoked negative teacher comments in kindergarten and the temporary diagnosis of a learning disability. She overcame those initial obstacles, flourishing in primary grade mathematics and was placed in the gifted program. She remembered working with manipulatives and enjoyed competing in multiplication fact races. As Wiest (2001) observed, "Girls seem to do fine in mathematics until the middle grades" (p. 14).

Fifth grade, however, brought about a drastic decline in Laura's perceived ability in mathematics. With blatant gender bias, her teacher often commented that females were not good in mathematics and favored the boys in the class in terms of praise and opportunities. Laura, and the other fifth grade girls, were not allowed to take the mathematics placement test for middle school, which resulted in Laura being put into a mid-level track for middle school mathematics. Even with incomplete mathematics content from fifth grade, Laura sensed that the higher tracked mathematics class would suit her love of a challenge and prepare her for high school. "Homogenously grouped classes are usually taught essentially the same content, but the higher the level, the greater the depth and breadth of mathematical ideas and the more rapid the pace" (Kilpatrick, et al., 2001, p. 346). She found some of the mathematics in middle school to be "way too easy" (Int. 2, L. 356) and even though gifted services were unavailable, Laura had an "awesome" (Int. 1, l. 181) mathematics teacher who, for two years, helped her gain basic mathematics skills from fifth grade. With an "absolutely wonderful" eighth grade mathematics teacher (Int. 3, L. 49), Laura enjoyed mathematics with a renewed confidence in her abilities.

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[10] "By the year 2000, all children in America will start school ready to learn" was one of eight National Educational Goals stated in the "Educate America Act" (H. R. 1804, 1994, Sec.2). "School readiness involves not only academic knowledge and skills, but also physical health, self-confidence, and social competence" (Integrating Community Services for Young Children and Their Families, 1993, ¶3).

Laura took Algebra I as a high school freshman, succeeding well enough to elect to take two mathematics courses in her tenth grade year: Algebra II and Geometry. With an exceptionally encouraging teacher and her propensity for success with algebra, Laura did well in her second-year algebra class, perhaps due to the way the content was structured. "For example, in algebra, I could do the formulas; I could do the pencil/paper" (Int. 2, L.584-585). Chazan and Yerushalmy (2003) describe high school algebra as:

> Cut and dried…Students are taught solution methods, for example, how to simplify and factor certain expressions, how to solve certain types of equations and inequalities in one unknown, and how to solve systems of two questions in two variables. Most of these methods can be described in four or five steps. (p. 123).

They advocate curricular and instructional changes to increase algebraic understanding. Although Laura could do algebraic procedures, she struggled with applying them to different situations, such as the word problems on the *Praxis I* Mathematics test.

Because of her accomplishments in algebra, Laura was initially surprised that she was not successful in geometry which she also took in the eleventh grade. Low teacher expectations played a role at the beginning of the year. "I didn't understand it, and she told me that I never would because I was too bright to figure out geometry" (Int. 1, L. 351-352). Perhaps this influenced Laura's assessment of her own abilities in geometry, "I definitely didn't have a brain for thinking that way because, of course, I didn't have analytical skills" (Int. 2, L. 596-597). She also noted that, although she had had geometry topics in the fifth through the eighth grade, physical models or manipulatives were never part of that instruction. Laura even speculated that her geometry teacher may have lacked content knowledge in geometry. Ball, Lubienski, and Mewborn (2001) emphasize the important connection to student learning of teachers' deep content knowledge in addition to pedagogical content knowledge.[11] If Laura's teacher lacked content or pedagogical knowledge, it might explain her dire prediction of Laura's performance in class, and Laura's subsequent struggles despite extra help on geometry from her algebra teacher.

The advanced mathematics class in eleventh grade appealed to Laura's sense of competition and challenge, and she made A's and B's all year long. The teacher, though unconventional, encouraged Laura and made her feel that she was capable of succeeding. Yet despite her initial plan to take five mathematics courses in high school, Laura changed her mind after her tenth grade year and the negative experiences with geometry; she elected not to take calculus in the twelfth grade. Instead, she took physics and did well, attributing it to a "natural innate ability" (Int. 3, L. 84). Although Laura demonstrated considerable effort in mathematics, believing that accomplishment in geometry and other difficult subjects was the result of innate ability undermined her learning. "The relative importance people assign to factors beyond their control, like ability, compared to factors that they can control, like effort, can strongly influence the way they approach learning" (Stevenson & Stigler, 1992, p. 106). The teachers who promoted the idea that Laura lacked an innate ability in mathematics sabotaged her confidence and learning in subsequent classes, exacerbating the situation, according to Stipek and Gralinski (1991), where females have a greater tendency to attribute failure to a lack of ability.

[11] "Pedagogical content knowledge is a special form of knowledge that bundles mathematical knowledge with knowledge of learners, learning, and pedagogy. Those bundles offer a crucial resource for teaching mathematics because they can help the teacher to anticipate what students might have trouble learning and to have ready alternative models or explanations to mediate those difficulties." (Ball, et al., 2001, p. 453).

Determining the impact of the Appalachian culture on that learning was less transparent but gave rise to connections related to school variables, stereotypes, racism, and family influence. Most of the negative school factors that Laura experienced related to the rural poverty of the region.

> Some studies have suggested that the basis for the [SES-based] differences resides in the opportunities available to students, including opportunities to attend effective schools, opportunities afforded by social and economic factors of the home and school community, and opportunities to get encouragement to continue the study of mathematics. (Kilpatrick, et al. 2001, p. 141).

Laura's limited opportunities for positive, effective instruction at all grade levels and for extra support in order to take and succeed in higher mathematics classes may have resulted in the fragile and shallow mathematical understandings (Hiebert, 1999, 2003) that caused difficulties in later mathematics classes and on the *Praxis I* Mathematics test.

Outside of the connection to rural poverty, the Appalachian culture appeared to have influenced her learning in less obvious ways. Weller (1965) suggested that Appalachians have a sense of fatalism where "passive resignation becomes the approved norm, and acceptance of undesirable conditions becomes the way of life" (p. 37). This idea of inevitability could be related to her acceptance of her teacher's assessment that she just didn't have the brains for geometry and in her reluctance to challenge her placement in middle school mathematics. In regards to the pejorative Appalachian stereotype, Laura was determined to prove it inaccurate. She rose to the opportunity when a university faculty member made a disparaging remark to the class about people from where Laura lived.

As a member of a minority group within the Appalachian culture, Laura also endured discrimination as an African American. Although she didn't connect racism to any of her negative school experiences prior to high school, it may have also played a role in her lost opportunities in grades K through 8. In addition to having few classmates who were African American and almost no teachers who were African American, she often pondered, "Why is there no one else who looks like me?" (Int.3, L. 274). Davenport (1998) wrote of being an "Afrilachian," a unique mix of the Appalachian and African American cultures, impacted by both. Neither of Laura's cultural backgrounds seemed to be addressed in a positive way within the region.

Laura's place within the Appalachian and African American cultures began with her family, and this worked to Laura's benefit. Her family highly valued education and provided the encouragement and support she needed to navigate through a sometimes hostile school environment. From her parents she learned a strong work ethic and held a job while she attended college. In regards to being an African American in Appalachia, she realized she was in an extreme minority, but she did not recall incidences of racism until high school. She spoke of one exceptional high school teacher, in addition to her parents, who taught her how to weather those types of storms. And weather them she did, finishing college and graduate school, now working as an elementary teacher.

# Chapter Five

## Faith's Story

Faith was a student in two courses that I taught within Teacher Education Program [TEP] at a small private college in Central Appalachia. She was a very dedicated student and did well on all class requirements. Before she could be formally admitted to the TEP, however, she had to take the *Praxis I* Test and make the minimum score on each of three parts, a requirement for teacher licensure in Virginia. She had successfully met the minimum score on the reading on the first attempt in June 2001, and the writing section on the second attempt in September 2001, but after 2 attempts had not yet passed the mathematics portion. I talked to Faith about some ways to study for this test, and we arranged times to meet and review the mathematical topics. In addition to tutoring her in my office, she did the mathematics problems from a workbook of word problems, *1001 MATH PROBLEMS* (Tarbell, 1999). After months of study, Faith took the mathematics portion of the test again in April 2002, and passed it with one point to spare.

Faith is a very capable and hardworking student, as shown by her grades in all her course work and the quality of her work in the courses that I taught. During our tutoring sessions, we talked at great length about her school experiences in learning mathematics as compared to other school subjects. While she saw herself as a good student in all other subjects, she expressed a lack of confidence in and a dislike of mathematics. In our conversations, I learned that the dislike of mathematics began with experiences in elementary school.

Through my efforts to tutor individuals, like Faith, who needed to pass the *Praxis I* – Mathematics test and who were good students, I became interested in determining if a connection existed between their experiences in public school mathematics and their performance on that test. In the summer of 2004, I asked Faith to participate in a pilot study to explore her mathematics background. She participated in three interviews (July 20, July 28, and August 4) and provided copies of standardized test data, as well as completed questionnaires about her family, community, and school. As I began my dissertation, my research questions evolved into exploring the life stories with an emphasis on school experiences of individuals who had grown up in Central Appalachia. I asked Faith, in May 2005, if she would participate in one more interview, and she agreed to do so.

### *Current Status*

Faith is a 23-year old Caucasian female, born and raised in Central Appalachia. She earned a bachelor's degree, along with a teaching license, at a small private college near her home. She is completing her first year as a teacher of primary grade students in a small rural elementary school in a neighboring county. She is very enthusiastic about her students, and according to the principal and parents of her students, is doing an excellent job.

Before Faith and I met for the 4$^{th}$ interview, I had asked her to be thinking about a graph of her confidence and abilities in mathematics for her public school years. She asked me if it mattered what type of graph she could use, and I told her it was her choice. She said that she would draw a graph like one her kindergarten students might draw. So when we met, she had already drawn it.

> I did my scale with smiley faces and frowny faces. And for the smiley face, that means that math is wonderful. I was having a great time, and I loved it. In kindergarten, first,

second, and third grade, I just thought math was the greatest thing. Then when I got to fourth grade I changed, and I said, "Math was O.K." And I think that was because it was starting to become challenging. And then in fifth grade I just had one horrible year all around. And I hated math from fifth through twelfth grade. It was just horrible. I hated it, and I really tried to avoid it as much as I could. (Int. 4, L. 7-14)

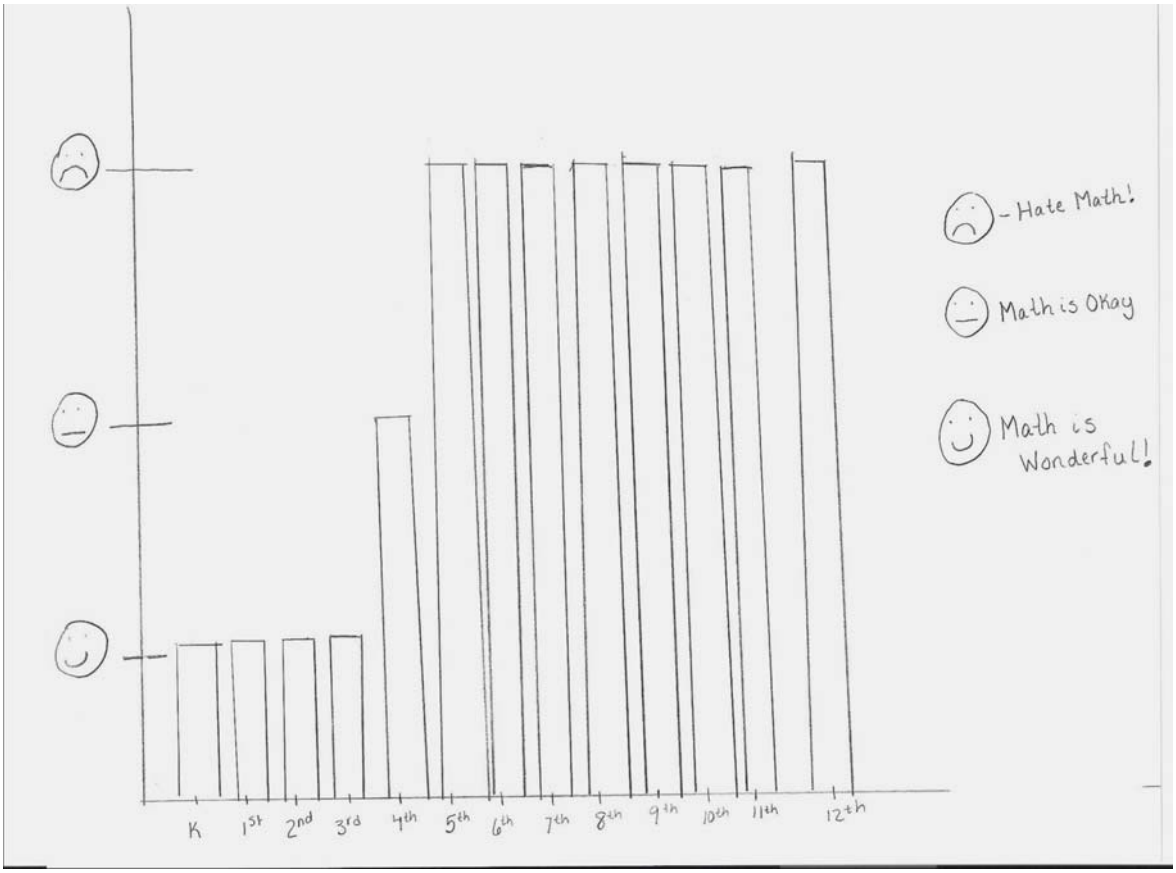


**Figure 2:** Faith's Chart of her Interest, Capabilities, and Confidence in Mathematics for each year of public school. The shorter bars correspond to a "smiley face" meaning "Math is wonderful!" The medium height bars denote, "Math is okay." The tallest bars, corresponding to a "frowny face" mean, "Hate math!"

*Pre-Kindergarten*

Faith had very happy early school experiences. She attended a church preschool in her community for half a day on Tuesdays and Thursdays with her mother as the teacher. The mathematics activities she remembered were, "Basically learning to write the numbers, learning the numbers and corresponding how many each number is" (Int. 2, L.18-19). She enjoyed this situation and recalled: "School was fun and the excitement of going to big school after I finished pre-school" (Int. 2, L. 28-29).

*Elementary School*

Faith attended Mapleton Elementary School in her hometown for grades K-4. While her graph (Figure 2) shows that she loved mathematics in the primary grades, she had few specific

memories in grades K-2. She couldn't recall the name of her kindergarten teacher, but remembered some fun activities. "I remember, this is silly, but I remember parties, having parties in kindergarten. But other than that, as far as math activities, I can't remember" (Int.2, L. 41-42). In first grade, she recalled doing worksheets for mathematics, and that she thought very highly of her teacher:

> I remember my first grade teacher, that was Ms. Perry, and I always wanted to be like her. She was just an excellent teacher and what I remember most about her was how caring she was. That's the one thing I remember most. (Int. 1, L. 111-113)

She also recalled a science project in first grade that had a special connection to her family:

> We had a program called "Invention Convention," and you were to invent something with the help of your parents. My mom had just broken her arm, so I invented a sling that had pockets on it to help people who break their arms. I just remember that that was a lot of fun. (Int. 2: L. 58-61)

In second grade, her teacher, Ms. Boothe, was her mother's close friend. She remembered doing "a lot of group work in her class" (Int. 2, L. 72) in addition to one big project:

> Second grade I remember we had a Mexican Fiesta and that's the one thing I remember. We had studied the Mexican culture, and we had a big celebration afterwards. That's about as much as I can remember for K-2. It's sort of vague. (Int. 1, L. 114-116)

Faith enjoyed learning multiplication in third grade even though she recalled "having to go up to the desk and recall multiplication tables to [her teacher] Ms.Mullins" (Int. 2, L. 78-79). She also felt more comfortable in class without her major rival.

> The farthest back I go with a math memory is in third grade and that was learning multiplication tables. I enjoyed it, but … the other student that I constantly competed with was in the other classroom. So it was a more laid back atmosphere for me. I enjoyed math in 3rd grade because of that fact. I just remember learning multiplication tables and having to go up to the teacher to take your oral test, to recite your multiplication tables. I remember my parents working with me too. My dad and my mom helped me to learn my multiplication tables. (Int. 1, L. 120-127)

The other memory from third grade centered on a school eye exam, "I remember, this really isn't related to school, but I had to get glasses. We did eye exams at school and I found out I had to get glasses, and I was devastated." (Int. 2, L. 89-91)

> Faith recalled only a little about fourth grade with teacher, Ms. Coleman.:
> I think what I remember from her class would be group work as well [as in third grade]. We were always in groups, and we got to name our groups. We had animals in our classroom, a bunch of mice. (Int. 2, L. 103-106)

I asked her how the groups were chosen, and she replied:

> The students did not get to choose. I don't think they were chosen on ability. Of course I can't remember, as a student you're kind of oblivious to the ability. I think it was just random. (Int. 2, L. 110-112)

She drew a conclusion by answering my question about mathematical memories, "I just don't remember. I think I enjoyed it, so I really don't remember having any bad memories. It was all just a part of school" (Int. 2, L. 116-117). Noting that on the her graph (Figure 2), Faith had gone from "Love math" in grades K-3 to "Math is okay" in 4th grade, I asked Faith what was different. She replied:

> Well I had homework but I just think that the fun kind of went away and it was more drill and practice, textbook and I'm a person that has to see it and feel it before I can comprehend it and that just was starting to slip away where I'd had it previously. I think that's when I started just to not really like math as much as I did. (Int. 4, L. 20-24)

The enjoyment of school, especially mathematics, diminished considerably as Faith entered the fifth grade. "Up until 3rd or 4th grade I felt like I was a great student with math, but when it got to 5th grade I was thinking something went wrong and I didn't like math as much" (Int.1, L. 23 - 25).

*Middle School*

In fifth grade, Faith was considered to be in middle school where she switched teachers during the day. "They had a middle school at Mapleton. It was just part of the elementary and we switched, I think, for math and I can't remember. But I know we switched for language arts and math and maybe science" (Int. 2, L. 121-123). Bad experiences in mathematics class were compounded by the disturbing events and teacher attitudes in her homeroom and language arts classes.

> She [Ms. Howard] was my homeroom teacher and I had her for language arts and then I switched for math (Int. 2, L. 146-147)

> I was scared to go to school because of my teacher [Ms. Howard]. She wasn't very nurturing, and a lot of bad things happened in her classroom…Students getting beat up in the corner. I was scared of other students coming in. I know one student was beaten with a broom. Rocks being thrown out of the windows and hitting buses. She had told us the first day if you're going to fight, she was going to sit and watch it. She's not going to break it up…Ms. Howard had been in trouble before for tying a kid up. The rumor had gone around that it was true and she explained it to us. So I think that's also what sort of made me scared to come to school. Before then I'd always loved school. (Int. 2, L. 133-135, 139-142, 174-177)

> My homeroom teacher [Ms. Howard] had, and this I just remember, she had told us that she had tied a kid up to a chair with a jump rope and if we wanted to fight in the classroom that she would let us. One day a boy was beat with a broom, and I was just

> scared to go to school. I hated math even more and I woke up just dreading going to school. (Int. 4, 36-39)

> [Ms. Howard] was weak in all subjects. If fact, one memory I do have is that I had problems writing in cursive my m's and n's. And she wrote on my paper and gave it back to me, and she wrote "This is you [sic] last chance". I couldn't get over that because as a 5th grader I had seen that she had made a mistake [of writing "you" instead of "your"], and she was constantly doing that. She had been in trouble before over how she treated her students, so I was scared to go to school, and I had always loved school. So I was scared to go to school because the kids were just misbehaving, throwing things out of the window, fighting, and I was really scared. (Int. 1, L. 154-161)

> It [the school] was very disorganized. Nothing seemed to be organized and no set schedule. As far as discipline, I think if it was that major you were sent to the principal's office and that's all I can remember from that. I just remember I was scared, I would constantly be scared and when I would get off the school bus everyday it was just like a sigh of relief that I made it a day. It was so bad. (Int. 3, 70-74)

Faith vividly described her fear of attending school in 5th and 6th grade and said that her parents went to the principal about the actions of Ms. Howard, and he promised to monitor her. But nothing seemed to change, even after a challenge in court:

> A really close friend of mine, she [Ms. Howard] smacked his arm one day. I know his parents took her to court, but she was protected and nothing ever happened from that. A lot of the students were scared to even go to school. (Int. 1, L. 171-173)

The 5th grade mathematics class was not filled with threats and violence like the language arts class, but Faith began to dislike the subject because her teacher, Ms. Cecil, emphasized competition and speed:

> I was thinking about it [the 5th grade mathematics class], and I realized there were math competitions and I would have to go up to the board, usually against my rival, another student, she was a girl, and I felt intimidated. The teacher would give you the question and whoever wrote it down fastest and solved it fastest was the winner. So, after constantly being the loser I began to hate math. I hated the game, and all I wanted to do was slink back in the chair. That's where I started to hate math. (Int. 1, L. 25-31)

> The fifth grade math class was very competitive, and I was one of the top students. And if I didn't win the challenge up at the board, then I was just devastated. More and more I started to lose and that made me not even want to attempt it, to go up in front of the class. So that was one reason why I hated math because I found it embarrassing to go up in front of the class and then lose and everybody was like, "I can't believe you lost", because I was expected to win, being an A student. The whole year was horrible. (Int. 4, L. 29-35)

> I think that with also feeling that I did have the weakness [in mathematics] and doubled with that competition and constantly losing made me just hate math. So I think from that year [in 5th grade] when it really started and it just continued on after that…Oh, I hated math. I would dread going to class everyday. I would get so nervous that the teacher would call on me, and of course I looked like an idiot in front of the class. And here I was a "straight A" student, and it was embarrassing not to know. Everyone expected me to have the answer and when I didn't it was very embarrassing for me. So I would dread going to class, I hated it. In middle school, everyday I dreaded math**.** (Int. 1, L. 36-38, 43-48)

> I think that the material [mathematics content] was taught in a way that was hard for me to understand and more emphasis was placed on speed than on getting things correct. It took me a while to figure things out, which made me feel stupid if I didn't get it in a certain amount of time or wasn't able to do it mentally…I do not remember the actual grade I made but I've never failed a math class. I just have this view of being perfect. So a B to me would be devastating. (Int. 2, L. 157-160, 164-166)

> I feel like it [the dislike of and loss of confidence in mathematics] definitely started in middle school, in the 5th grade, because [in] all of my memories up until 5th grade, I don't remember hating math so much. It was just another subject. Looking back my ill feelings towards math started in 5th grade. (Int. 2, L. 348-351)

> I think that the fifth grade year just kind of ruined my whole school experience because all it took was that one year to make me, it just kind of like devastated me because I was the type of person that just loved school and it got to the point that I didn't even want to go to school. I think if I could have some how gone back and erased that year and done it all over again differently then maybe I would have had a different outcome. (Int. 4, L. 125-130)

In sixth grade, the same problems persisted. Faith had the same language arts teacher (Ms. Howard) and the same mathematics teacher (Ms. Cecil). I asked her to talk about her sixth grade mathematics class. She said, **"**It was the same basically. Such emphasis was placed on competition that I was miserable" (Int.2. L. 187-188). She recalled that, in sixth grade, her dislike of mathematics grew even stronger:

> I think it [mathematics] just got more competitive and I just disliked it more and more. It got challenging, and I felt like I didn't have the help that I needed and I would have different people try to explain it to me in my family and it still wouldn't get across. I think it was because my confidence had gone out the door. I just didn't have any confidence. I didn't want to do it and I got frustrated and I would start crying because I didn't understand it which in turn makes it even worse. I just wanted to avoid it all together. (Int. 4, L. 61-67)

Faith added a note to the transcript of Interview 2 demonstrating the concern of parents about the quality of the mathematics teaching: "My mom reminded me of a PTA meeting when my sixth grade teacher was questioned as to why the sixth graders weren't understanding [mathematics]

concepts; she replied that the students' brains had stopped growing." When I asked Faith about other memories of 6th grade, she replied, "Nothing really pops out to me about 6th grade. Just the fact that I was so miserable that I was considering switching schools" (Int. 2, 201-202).

*Junior High-High School*

To escape the discomforting situation at the middle school, Faith did switch schools. She explained:

> Seventh grade, I went to Barksdale because it was a 7-12 school. I would've had to go in 9th grade due to consolidation, but since I was so miserable I went ahead with another friend, and we ahead and made the switch early…I was always kind of shy so at first it was really intimidating but I made friends and I had a lot of fun. Ultimately I was glad that I did it. (Int. 2, L. 212-214, 218-219)

Overall, Faith enjoyed being at Barksdale for her junior high years. She recalled:

> Junior high was a great time. I had dances and basketball. Other subjects I loved and I remember doing a big project in English that I made a videotape of. It was just a fun time for me in junior high school. (Int. 1, L. 190-192)

The overall improvement did not apply to the mathematics classes, however.

> By then I had such a negative view of math when I switched, I had seven classes a day, and my math teacher was my basketball coach. I kind of slumped down in my chair, didn't want to be called on because I had such a bad feeling about math that I was stupid and I wouldn't be able to answer the question. I think that caused me to have even more difficulty with the 7th grade math class. (Int. 2, L. 223-227)

> Oh, I hated math. I would dread going to class everyday. I would get so nervous that the teacher would call on me, and of course, I looked like an idiot in front of the class. And here I was, a "straight A" student, and it was embarrassing not to know. Everyone expected me to have the answer. And when I didn't, it was very embarrassing for me. So I would dread going to class, I hated it. In [junior high] school, everyday I dreaded math. (Int. 1, L. 43-48)

Faith only remembered the feeling of dread in her seventh and eighth grade mathematics classes; she did not remember the name of her teacher for eighth grade mathematics.

Though Faith would be successful in algebra later in her schooling, her 9th grade Algebra class resulted in more familiar feelings of dread. She recalled:

> My Algebra I teacher in high school was just horrible. Everybody dreaded going to his class, not only me, but everybody else dreaded it as well…He taught on a level that no one could understand, and he thought the class was stupid because we couldn't understand him…It's a major memory, just a feeling of dread. I would wake up and think, "Oh, I don't want to go." I remember one class period one of the students actually

> stood up and cursed the teacher because he had just had so much. He had had enough. I think everyone else was feeling the same way but didn't have enough nerve to do it. (Int. 1, L. 752-754, 758-759, 763-767)

> Well it made it even worse because he taught above, and the students discussed this, we were always discussing our math class, but he taught above the student's level. Everyone, it seemed like, was having difficulty in this class. I did everything, looked for tutors, and I stayed after school for after school tutoring, and he did that. Which, one on one, he was a much better teacher. But when he got up in front of the class, it was just so above everyone's level that I would get physically sick. I was scared to go to that class because if you didn't know the answer then something was wrong with you. (Int. 2, 257-264)

> I think he [the algebra teacher] just assumed that we knew the information, but it was sort of unrealistic to think we knew all that he was teaching. Also I got the impression, and I think several other students got the impression, that he enjoyed his class being the difficult class. He just got enjoyment from that. Students would talk about how difficult this class was. I think that he sort of got feelings that he was the difficult teacher. (Int. 3, L. 98-103)

Faith felt uncomfortable in algebra class for other reasons, too:

> He was very flirtatious with the girls who would let him be. I sort of shied away, and he was more buddy-buddy with the guys in the class. Certain students he would let get away with more. He was more friendly to those, and I think he just had his picks. I just tried to slouch down in my seat and not be noticed, and I thought that would be the best way to get through it. Also, my brother had the same teacher when he was in high school, and my brother was always an excellent student, and he had the worst time in his class. A lot of other students did as well, and I think there were some complaints made. He would have students paint ceiling tiles for extra credit, and they would have to put like mathematical equations on the ceiling tiles. I just remember my brother bringing home tons of ceiling tiles to get extra credit. I think he was more friendly with the girls who flirted with him and things like that. (Int. 3, 122-133)

When I talked with Faith on the telephone (May 20, 2005), I asked her more about this teacher's inappropriate flirtations, and she said that it made it very hard for her to ask for help because she was unsure of how to approach him. She also recalled that these actions seemed to be a generally acceptable practice. There were two male teachers in her high school, during her years there, who divorced their wives and married students from the high school. Faith even dropped a science course after learning that one of these men would be teaching it; the wife he divorced was a teacher in the school whom Faith admired and respected.

Faith took geometry in tenth grade and, although her teacher was much more approachable, she felt unsuccessful in this course:

> Geometry I remember was very, very difficult. I had trouble just with the concept of it, but I had excellent teacher. She just made it where you weren't afraid to come ask questions. I remember not doing as well in this class as in all of the other classes I was taking, but I was happy with what I made because I really worked hard. (Int. 2, 283-287)

> I hate geometry. I had the hardest time with geometry. I was always told if you're good in algebra then you're not good in geometry, if you're good in geometry then you're not good in algebra. So of course I was better at algebra so I thought I was horrible at geometry. I feel like I wasn't as talented as much as I should have been in geometry. Just like writing proofs and things like that in high school because we didn't have to do that but I just had a horrible time with geometry and everyone else in my family did too. (Int. 1, 338-344)

> In geometry I had the same teacher that I had for Algebra II, and she was a good teacher but it was like I just didn't comprehend it. I had always heard the saying that if you're good in algebra, you're horrible in geometry. So maybe I just went in with the stereotype that I am going to do horrible, but I just didn't understand it…I just always heard that. Everybody tells you. It might just be this myth around here that if you're good in geometry, you're bad in algebra and if you're good in algebra, you're bad in geometry. (Int. 4, L. 518-522, 526-528)

Faith took Algebra II in the eleventh grade from the same "wonderful" teacher, and the predictions of being better in algebra than geometry were true:

> [For] Algebra II, I had the same teacher [as Geometry]. I had Ms. Adams, and I had this class with my best friend. She is a math whiz. We sat beside each other and she would help me out if I had trouble. Also Ms. Adams, I was not afraid to ask questions, and I would just practice and work with my best friend. Algebra II just came easy, it was like the light bulb clicked. It turned on. (Int. 2, L. 301-305)

I asked Faith what caused her confidence in mathematics to increase at this point. She replied:

> I think the atmosphere, not being scared, not being afraid to ask questions, not being made to feel stupid if you don't know something, because you are the student and you're there to learn. Also, the group work, allowing you to work with people who understood. They understand the concept and then they can teach it to other people; she allowed that to take place. And that I think is one of the reasons that I succeeded. (Int. 2, 311-316)

> With Algebra II, I don't know if this might be a connection, but just working the equations and I know in Chemistry where you have to balance the equations, I always enjoyed that. It was like a challenge but I enjoyed it…I feel if it has steps then I can do it. It's much easier that way. (Int. 2, 374-376, 381-382)

> Equations were always, algebraic equations and things like that, were always easier for me than taking geometry or things like that for some reason. I'm not sure why…It could have been because it doesn't seem quite as mathematical. I don't know if that makes sense. But it's not quite as mathematical, that's maybe why equations weren't as hard for me. (Int. 1, 311-315, 319-321)

Because all the bars were high (meaning she hated math) on her chart (Figure 2) throughout high school, I asked Faith if there were any teachers who had encouraged or helped her in mathematics.

> Yes, I did actually. My, I think it was Algebra II, she was just a wonderful teacher. Her personality matched mine I think. Very quiet, reserved, laid back. Also a really good friend that I had the class with and she helped me and the teacher was just very supportive. She knew if I was uncomfortable and she wouldn't call on me and I didn't have to be as scared but I still, because it was so challenging, I still didn't like math. (Int. 4, 101-106)

The yearly grades for Faith's high school mathematics courses were as follows: Algebra I (80), Geometry (87), and Algebra II (96). Her cumulative Grade Point Average (GPA) at the end of the first semester of her senior year was 96.586, and she was ranked 3 out of a class of 47. (High School Transcript, 2/08/00)

Even though she had been more successful in eleventh grade mathematics, Faith chose not to take a mathematics course as a senior. She explained her reasons:

> I took Algebra II in high school and that was the last math class that I took. I got out of taking Trigonometry and other math classes because I was scared. I did not want to take it. I didn't want it to pull down my GPA because I was in competition to get the top spot in the class. So I avoided math all together. (Int. 1, L. 197-201)

> I was signed up to take Trigonometry, but I dropped Trigonometry because I just had had enough math, and I thought, "This being my senior year, I don't need it. (Int. 2, L. 320-322)

I asked Faith if anyone recommended that she take another mathematics course in order to be better prepared for college. She recalled:

> I did have a guidance counselor. When I was in high school they had just started a "High School that Works" program and you had to have so many credits of each thing and it was just starting out so it was a bit confusing and kind of disorganized. I think my guidance counselor had just mentioned something sort of lightly like, "You may want to try and take that", but I was determined and I said, "No, I don't really think I need it". Then I went to drop the class from the math teacher [Ms. Adams], and she tried more so to talk me into taking it and I was just like, "I really don't want to take it and I hate math and I don't want to take it". (Int. 3, L. 140-147)

> Everyone knew I was going to college, and I was just under the impression that I was going to take something that didn't require a lot of math. Well what I did take, it did require math but looking back I wish I would have taken the class. No one ever really connected it to college. The teacher did that was my excellent teacher [Ms. Adams] in high school. She sort of said, "You might need this for college," and that's when I said, "I'll try to avoid math." That was my mind set; I was going to avoid it. (Int. 3, L. 151-157)

Faith liked and enjoyed high school, becoming involved in many activities. She described high school in general:

> I loved it. I was in AP English, and I was in yearbook. Very active in extracurricular activities, basketball. I just had a lot of fun in high school. There were dances, prom and all those memories that come back to me, and I remember doing my senior project on my family tree. I had so much fun looking back into my family and the genealogy. I really enjoyed my senior project. (Int. 1, L. 203-209)

> Besides math, I had a lot of fun at school. I played basketball. It was an extracurricular activity. I made good grades and I had always planned to go to college. (Int. 2, L. 327-329)

Mathematics, however, remained the one subject she could not enjoy:

> I hated math. I loved school; I absolutely loved school. I loved learning, and I loved doing homework, but I just hated math. I dreaded it, and I hated to not understand because I would feel stupid like something was wrong with me. Math was always making me feel that way, so I just hated it. (Int. 1, 214-217)

*College*

Faith enrolled as a commuter student at a small private college not far from her home town. She discussed her choice of major:

> Well this is a funny story because I went through so many different things that I wanted to be. I always wanted to be a psychologist because I felt like I related well with people. Then I wanted to go into business and public relations and that was what I had planned to do when I went to college. My freshman year, right before I went, I changed my mind and said, "You know, I want to be a teacher." All of the sudden just like that. But I can always remember growing up I would teach to my stuffed animals. I would line them up and I have a lot of teachers in my family and they would give me like old teacher edition books, and I would use them like I was teaching to my stuffed animals. When I was a freshman in college I just decided that this is what I wanted to do. I was also thinking that if I ever had a family and wanted to have kids of my own that that would be a wonderful job to have the same hours and to have the summers off. (Int. 3, L. 400-411)

Although her first encounter with mathematics in college was a placement test that put Faith into a non-credit mathematics course, she ultimately experienced success as she moved through the program's mathematics requirements. She also appeared to have undergone a dramatic change in attitude toward mathematics:

> When I entered college I had to take a test for math placement and English placement. My math placement was in the remedial math. And the first week in remedial math you were able to take another test, and I tested out of it in the first week of the class. I went on to College Algebra I and I had a professor who was so smart that he reminded me of

> my [Algebra I] teacher in high school that taught above. Several people in the class understood, but a lot of other students struggled in this college algebra class. I went back to my high school and tutoring, and I came out of that class with a C. My next class in college was College Algebra II. I had an excellent professor, and I had an A in College Algebra II. I actually enjoyed that class. My next class was Statistics and I took that as a summer class because I wanted to have the same professor as I had for Algebra II. I also made an A in that class, and I missed the first week because I was on vacation. I came back and I got caught up, and I just enjoyed it. I really, really enjoyed it. I'm pretty sure that that's all the math that I had. (Int. 2, 512-525)

> In college Algebra I was the hardest. I struggled with that class. I finally came out with a C but in my Algebra II, Statistics, and Chemistry, where you're using math, I made straight A's. So I did better once I got through my freshman year at college. I started feeling successful at math again. (Int. 1, 58-61)

> I had a really hard Algebra I class [in college], and I came out of that with a C. I went and got tutored for that and that was the last really difficult math class for me. I went on to take Algebra II and Statistics, and I made A's in both of those. I loved it. I loved math, I loved those math classes because I understood. Suddenly something just happened and I understood. (Int. 1, 221-226)

I asked Faith to think about what made the difference in those last two college mathematics courses. She considered the teacher of those courses to be a major part of her increasing confidence in mathematics:

> Maturity, I matured a great deal over that time period, and also I had a wonderful math professor in college, wonderful. I wasn't afraid to go ask for help, and I did several times. I think that's what helped me, not being afraid to ask questions because before I had always been afraid that I would look stupid. I think that as I matured I wasn't afraid to ask questions anymore. Also, her attitude as well because she didn't act like it was a bother, and she always told you if you had problems to email or come by her office. I think that's what helped me the most. (Int. 1, L. 231-238)

> Because more than one way was taught how to do problems. Also you could choose which way you wanted to do it. Just not being afraid to ask questions. The office door was always open and plenty of examples given to sort of help you out. We would do it as a class so if you had questions right there in class then you could ask before you went home and went over your homework and did practice problems. (Int. 2, L. 535-548)

> Without a doubt, I feel that it was a combination of everything [the instructor, classmates, maturity level]. The maturity level, definitely. It seemed to just click once I was in my second year of college, it just clicked. Also I think it was feeling more comfortable working with my friends. I made some outstanding friends in college and I just felt comfortable working with them. The professor that I had in college, I had two math professors, the one I didn't do so well in, but the other I had for other classes, and I felt so comfortable with that professor. Just breaking things down where I could understand

> and I feel like I worked harder in college too. It just seemed more important to me and I really worked hard at that. (Int. 3, L. 248-256)

> In college though it was different, a more supportive environment, and I found just working with my friends helped me because if I didn't understand something then maybe they could explain it to me or if I understood something I could explain it better to them. That helped more than anything, you know, just having that peer support to help. (Int. 1, L. 92-96)

Success in two college courses, however, didn't completely alleviate Faith's lack of confidence in mathematics.

> I started to feel more confident, but it was just those past experiences that would always sort of bring me back down to reality. Although I was gaining confidence and I was starting to enjoy math and I was enjoying the challenge, but I still kind of had this fear of not succeeding. I had a fear of failure. (Int. 2, L. 530-533)

Her fear of failure in mathematics would be affirmed as she took a required competency test in mathematics, Praxis I.

*Praxis-I Mathematics*

As part of the requirements for admission to the teacher education program at the college and as a requirement for state teacher licensure in Virginia, Faith took all three parts of the *Praxis I* test: Reading, Writing, and Mathematics. She passed the reading portion, missed the writing portion by 1 point, and was 5 points below the minimum in mathematics. I asked her about that first experience with the test and if she thought she had passed the mathematics portion the first time. She replied, "I was not sure, to be honest. I had no clue. I didn't feel very confident because a lot of the information on there was not recent and I really was unsure" (Int. 2, L. 426-427). Because the test is timed, I asked her if she had finished the test. She answered, "No I did not because I've always been a slow worker. I was rushed, and at the end I think I had been told if you run out of time just to fill in circles, so I'm pretty sure I just filled in the rest of the circles" (Int. 2, L. 434-433). Faith felt that not being allowed to use a calculator on the test contributed to her performance:

> I hated [not being able to use a calculator]. I felt very uncomfortable, and I feel that if I'd had a calculator I would have done much better because after you get out of elementary school you're allowed to use a calculator in almost every class so I've been using a calculator since I was in 7$^{th}$ grade. (Int. 2, L. 437-440)

When she received the scores from that first test, "I was disappointed, but I kind of expected it in a way, since I've always been weak at math. I kind of expected it" (Int. 2, L. 445-446).

To prepare for the second attempt at the writing and the mathematics tests, she said, "I basically just read a Praxis Review book and tried to do problems, but it wasn't much. To be honest, it wasn't much" (Int. 2, L. 450-451). In regards to her confidence level on the second test, she remembered, "I felt about the same because [on] the first test that I took, I passed the reading part. Then the second time I took it, I think I was more focused on passing the writing

part. So I focused on that instead of the math" (Int. 2, L. 456-458). The second disappointment of failing to make minimum score on the mathematics test caused Faith to question her decision to become a teacher:

> I was very discouraged. People around me were having trouble with the Praxis test, and we would just gripe and complain that this would somehow affect our dream. My best friend, who we always talked about maybe one day teaching together, had to change her major because of the Praxis test. I was determined that I was going to pass this. I worked and the one-on-one tutoring helped me the most. I feel that if I did not have that, I would still be trying to pass the test. It kind of made me question, maybe I shouldn't become a teacher, maybe I need to be doing something else. (Int. 2, L. 568-576)

> On the third attempt, Faith only took the mathematics portion of the test. She noted: I really prepared for it this time. I was tutored, and I just went over basic math skills from elementary school. I went in feeling much more confident and that was the only test that I was taking, so I felt much more confident. A lot of the questions looked more familiar, [along with] the terminology and I was just much more confident. (Int. 2, 463-467)

She passed the mathematics portion of the test with one point above the minimum requirement. I asked her if it was her increased confidence or increased knowledge of concepts and skills that had made the difference. She replied:

> I think it was both equally because the confidence was definitely a factor because I went in there saying, "Hey, I can do this!", and that made me feel much more confident. Also the skill building, going over the terminology, how to tackle the problem to make it not so scary, and that you don't have to use everything that's given. A review of things from elementary school because I had not used them everyday, I didn't use those things everyday, I still don't use them everyday but just going back and familiarizing myself with them. I think that's what helped the most. (Int. 2, L. 473-480)

Faith's response to discussing the *Praxis I* mathematics test three years after she had taken and passed it was, "Oh, it was horrible! I don't want to remember it" (Int.4, L. 425). Then she continued to summarize her feelings about that time:

> Yes, thank goodness [I passed it]. And each day I just look back and I feel so proud because I know there are still some people out there that are struggling. And there's some people you hear that made almost the top score and you know that's a little discouraging, but it was a horrible time. But I was so focused that I'm going to do this, I'm going to be a teacher. And I did it, but it wasn't easy. The other two, the reading and writing, they came easier to me as always, but then the math I struggled with. After I had you tutor me, then I went back and tried it again and thank goodness that I passed. (Int. 4, 429-436)

> Actually, I think most of the test was middle school math, and I think I had forgotten it. Once it's been taught that's it, you never see it again. I think that's what happened; I just totally forgot how to do a lot of the problems that were on the test. (Int. 4, 441-444)

An additional requirement for receiving a teaching license for elementary school is to make the minimum score on another test, *Praxis II: Elementary Education: Content Knowledge*. The content knowledge portions of this test are: language arts, mathematics, social studies, and science; unlike the *Praxis I* in mathematics, calculators were allowed on this test. Faith took the test in November, 2003, and passed it on her first attempt with a score of 163 (20 points above the required minimum of 143). I asked her how she felt when she received that score in the mail, and she said, "Incredible! It made me feel really good, really good. In fact I didn't believe it when I got my score that I passed the first time" (Int. 2, L. 504-505).

*Reflections as an Appalachian*

Concerning her hometown; Faith wrote on the questionnaire, "It was a wonderful place to grow up because it was small, and everyone was so friendly." She also expressed appreciation for growing up in this region:

> I am a big fan of Appalachia. To me it's just, I guess where I've lived here my whole life, it's like a sense of pride that..... It's hard to explain, if you live here you know it and you can feel it, but if you're not from this area you don't fully understand. It's like a sense of community and closeness that you feel with your family and friends and community. It's like an older version of living, like Little House on the Prairie days when people look out for each other. That's just what Appalachia means to me, a closeness of families and things like that. (Int. 4, L. 136-142)

> The people in my community make it special. Everyone is so friendly and polite. I always think of southern hospitality. That's important, and I think that's what makes this community different than others. You know when you travel you don't always get the southern hospitality. And it makes you thankful for that. (Int. 3, L. 318-321)

> Another sort of label would be the Bible Belt, very religious, good church going people. That's what I think of and beautiful mountains, laid back atmosphere. Not everybody is always in a hurry to get somewhere, it's just the pace of life is a lot slower, more relaxed, laid back, comfortable. (Int. 3, L. 326-329)

> It was a very historic town with the extravagant homes built by the millionaires of the coal days but it was a small town and the neighborhood kids, we would ride bikes and all swim together during the summers. It was just a nice place to grow up because it was so small you could go downtown and ride your bike around town and not have to worry about crime or anything like that. Overall I really enjoyed living and growing up where we did. (Int. 4, L. 376-381)

Faith remembered a ninth grade class when I asked her when she might have become aware of this area as being Appalachian:

> Oh goodness. I know that I had an Appalachia class in high school. I forgot the name of it, but it was very interesting. It was a literature class, and we just learned about the area. And it was so much fun because we got to bring in things. And my dad was a coal miner so I got to bring in all of his things that he used in the coal mines. My family had all of

> these Appalachian recipes. I just really got into it and found it very interesting. So probably when I was in high school I became familiar with it. (Int. 4, L. 156-162)

She continued to describe her family connection to coal mining:

> A lot of times when people say Appalachia that's the first thing you think about is coal and I lived in a town in [state] that was known for its coal. And my dad was a coal miner; my uncle was a coal miner; my grandfather was a coal miner. That's kind of like all you ever know. You're just around coal all the time, and you know if you see the movie *Coal Miner's Daughte*r it kind of helps explain things. I just always... And too that's just associated with Appalachia, that's one big factor. (Int. 4, L. 359-365)

> My grandfather got black lung and he eventually died from lung cancer and my uncle now is, he's disabled and he has back problems from being in the mine. It's a very hard job. It's hard on the family too as well. (Int. 4, L. 369-371)

Faith expressed the belief that people from outside the region view Appalachia very differently from the way she perceives it:

> As hicks, uneducated, bare foot and pregnant, things like that. I hate it because I'm all the time feeling like I have to defend the region where I'm from because there's always, "You hillbilly this, you hillbilly that," and I have to come up with some quick response to put them in their place but it's just I hate the way that we are viewed. I really do. (Int. 4, L. 146-150)

Because poverty is especially prominent in Central Appalachia, Faith encountered poor students as she attended public school and now in the nearby area where she is a teacher:

> There was a lot [of poor students]. And I never really considered myself poor. But, you know, we weren't wealthy. And my brothers and I, there was never a time that we didn't have something that we needed. We were always fed and clothed, but as far as like an excess of toys and things like that, you know we were happy but we never had a whole lot. Then there were some kids that came to school, you know, with clothes that were just dirty, didn't fit and themselves they were dirty and you know [that for] some kids the lunch in the cafeteria might have been their only meal for the day. You notice in elementary school, too, the kids that are like that, they come to school like that and you can tell the difference. (Int. 4, L. 176-184)

> I was friends with them [poor students] because the majority of the class was poor. We kind of all became friends and close but I just, I never really went over to a lot of different people's houses. I had just like one close friend all through elementary school, and we would go to each other's houses. But as far as going to all of the other kids' houses I wouldn't. In the community there were a lot of other kids. My brothers and their friends, we would all play together. (Int. 4, L. 189-194)

> I have a variety [of students] in my classroom. I have, you know, several students who are very poor that sometimes I wonder if they come to school hungry. You know I'm wondering if they're fed outside of school and I do worry about them and if their needs are met. A lot of times I feel like their needs need to be met before they can even begin to start learning. When they're at school and their stomachs start growling, it's kind of hard to focus on English and math. Then I probably have a few that are middle class, and they get everything that they need, but I do have a few that are poor. It reflects in their work too because they're not getting extra help at home, and I can see that in the progress throughout the school year. (Int. 4, L. 224-232)

Faith also described her high school as poor and discussed how that may have affected the quality of her education:

> I went to a 7-12 school and I think academically it was a joke. Academically it was definitely a joke compared to other students who I talked to and things that they had to do while they were in high school. I felt sort of cheated. Also my high school seemed to be the poor high school. It was sort of in bad shape. The people who went there were sort of underprivileged. There were four high schools in the county and our high school didn't receive hardly anything. (Int. 3, 176-181)

> There was one AP English class and it was always considered a joke. I took that class, but there were no other AP classes offered. When I got to college, I started talking to other people and realized that I was behind because a lot of other students, not only math but other subjects, had taken AP courses and received college credits for them. I felt like I was behind because I was not given the chance. I would have in other subject areas, I don't know if I would've taken an AP math in high school, but in other subjects I definitely would have. ( Int. 3, L. 163-169)

> To me the school was always dirty. It seemed to be dirty. The classrooms were not very clean just the walls were dirty. There were TVs in every classroom because they did the Channel 1 News. Other than that I remember, it seemed like I stayed sick while I was in high school, and I feel that it was because of the school being so dirty. Looking back on it now, that's how I sort of feel. (Int. 3, L. 219-223)

Schools may have also been "poor" in terms of supplies and equipment. Faith recalled:

> I went to a probably was considered to be a poor high school, so I don't remember software except for in our computer class. Elementary school we would just have a certain time for the class to go to the computer lab and maybe then we would do a short period of language arts or a math game on the computer but that was like once a week. You rarely got to go because everyone in the school had to take turns using it. (Int. 1, 713-718)

> I'm not sure about [teachers] using their own materials, but in chemistry, we had partners and we had to share the lab with our partner. There were some [teachers] that used overheads. As far as history, there were never a lot of maps or anything like that, just a

> few hanging up. Math, I don't remember using any manipulatives or anything of that sort…When I had the excellent [Geometry and Algebra II] teacher that I had in high school, she had calculators at the school. And they had numbers on them and we came in and we checked out our calculator and we'd have to return it. But if you wanted to do homework, you wouldn't have your graphing calculator or anything like that. Luckily my brother had one and I was able to use his. (Int. 3, 229-233, 237-241)

Faith considered that the poverty of the region may have indirectly affected her difficulties in mathematics:

> I think that maybe I didn't get all of the opportunities that would have been available if I would have gone to a school outside of Appalachia simply because it's so poor here. We didn't have a lot of extra resources and things like that for us to do while we were in school. It seemed to be mostly drill and practice. We didn't have any activities or trips we could go on to help reinforce math skills. So I think that it might have been different if I didn't go to school here in Appalachia to help with my math. (Int. 4, L. 198-204)

*Faith's Family*

Faith comes from a very close-knit family consisting of her mother and father and two older brothers. Faith's mother had completed high school and some college courses, working as a preschool teacher and as a secretary. Faith's father was a high school graduate who worked as a coal miner, and later, as a school bus operator. Sadly, he was diagnosed with cancer and died when Faith was a high school senior, making the choice of a nearby college even more important. Faith's two older brothers, one with a bachelor's degree and one with a master's degree, also helped and inspired her: "I had also had my older brothers to sort of help me out whenever I need it" (Int. 3, L. 87-88). She explained her family's influence on her own motivation to be a successful student:

> They think that I'm an overachiever because I'm constantly going at it, trying to do the best that I can to be a "straight A" student. I've always looked up to my brother who has been an A student, and I've always felt like I had to do better than him, so they think I'm an overachiever. (Int. 1, L. 76-79)

> I'm a perfectionist and I feel like I always need to try and make somebody be proud of me. Maybe that's being the youngest child in the family too trying to get attention by doing well in my classes. (Int. 4, L. 343-345)

> One of my goals in college was to outdo my brother; we have sibling competition, but my main goal was to graduate with highest honors. I missed barely, and I graduated Magna Cum Laude and just the feeling walking across the stage when I had my three stoles on for my education honor society, my academic, and the other for being in the top ten percent of the class, I felt proud. I was like, "I did it!" I didn't quite reach my ultimate goal, but I did it and I was proud of myself. That was the best feeling when they called out my name and then Magna Cum Laude. (Int. 3, 373-380)

Faith's parents were actively involved in her education, especially during her fifth and sixth grade years when she was so scared and miserable:

> My parents went to the principal. My mom was very active in PTA. They went to the principal and he said he would monitor [the homeroom/language arts teacher]. (Int. 1, L. 167-168).

> My mom was up there [at the school] all the time, and the principal would sneak up to the classroom and try to like hide and stand outside of the classroom and try to catch [the homeroom/language arts teacher]. (Int. 4, L. 263-265)

> Well [my mother] was always very supportive, always an active role in the school. She had made several trips along with my father to the school. She was not happy and she was kind of pushing me to switch as well, which I ultimately did. (Int. 2, L. 206-208)

Because the school was so small, there was only one teacher for fifth and sixth grade language arts, and one for fifth and sixth grade math, few options existed. Faith recalled:

> There was only one teacher per grade so there was one fifth grade teacher and one sixth grade teacher, and we would switch classes so we didn't have a choice…Well my grades weren't that bad, you know, and really [my mother] got tutors and helped me at home but my grades really weren't that bad. She was up at the school about me being so unhappy at school but there really wasn't much else she could do. She complained but they weren't going to do anything about it. (Int. 4, 285-287, 292-295)

Because Faith continued to make good grades, it was hard to convince anyone that action was needed. She reflected on the lack of alternatives, "There's not much you can really do" (Int. 4, L. 299).

Faith considered the level of involvement of her own parents to be very good, despite the fact that few concentrated efforts to involve parents were initiated by the school.

> My parents were very involved and always willing to help out. My mom would always help us with our homework and then my brothers would help me with mine and they were just always so involved and maybe that's why we didn't have it [school sponsored activities for parents] when I was in school was because maybe the parents were more involved then what they are now. (Int. 4, 251-256)

When Faith struggled with mathematics in grades 7-12, her parents felt that they were not able to help her, so they sought tutors for her:

> Well, everyone in my family, except my brother, is weak in math. They would try to help but I think that was another reason why I hated math so much because no one else in my family really like it or enjoyed it. We've always been better at other subjects so they would always be helpful or my mom would always try to find me a tutor or something like that. But as far as sitting down and helping me, I think their attitude sort of was reflected in my feelings about math. (Int. 1, L. 243-248)

> I know when I got in junior high and high school my mom looked for a tutor for me. I also had my older brothers to sort of help me out whenever I needed it... I think several of the other students were having trouble as well and there were only a few that really understood. (Int. 3, L. 86-90)

In considering how many of her peers from high school might have also graduated from college, Faith estimated, "Five or ten [percent] because you always hear bits and pieces of a lot of the students who started college dropped out, and I'm not certain. But I would say between five and ten percent" (Int. 3, L. 391-393). I asked her then, what made the difference between her classmates and herself in terms of completing college:

> Two things I think. Family and personal motivation. I feel that if it wasn't for my family I couldn't have done it. They sort of helped me out and pushed me and said, "You're going to graduate." Also personal motivation, I decided to get up every morning and go to class and to learn. I didn't want to quit. I had always been taught, "Don't be a quitter," and I wasn't going to quit. (Int. 3, L. 398-402)

Although Faith played basketball throughout high school, she maintained an overall A average each semester. She credits her work ethic to the expectations and teaching of her parents:

> All the other subjects [except mathematics] just came so easy to me. I enjoyed them and I would, just as soon as practice was over, I would go home and do my homework because that's all that I had ever been taught, you know. As soon as you go home, you do your homework. I just couldn't go to sleep if I hadn't done it, and I knew if I had a test coming up that I would start studying for it in advance. It was just something that I enjoyed doing so much that I guess I knew that I had to keep my grades up to keep on doing it… I guess just growing up, I kind of learned [to get the schoolwork done]. It was a learned behavior, and I knew as soon as I got home I would need to do it. Being responsible I guess. (Int. 4, 326-332, 338-339)

> Academics were not important in high school. Not at the top of the list. It was more social and sports activities. At that age, its gossip, who's dating who, and academics is sort of put on the back burner. It was among my friends because we were more into sports and other things like that. However, my parents told me they still expected the best out of me. I really felt like I didn't have to work that hard to make good grades but in college I worked for my A's. I worked for them and in high school I felt like I didn't have to. (Int. 3, 264-270)

In addition to basketball, Faith's parents supported her in a number of extra-curricular activities including dance lessons, 4-H club and camp, and the church youth group.

*Final Thoughts*

Faith's dislike of mathematics in public school only increased her desire to effectively teach mathematics to her primary students:

> I'm excited. I just want to make them excited about math and use a variety of methods. I have so many ideas from my college classes. I think connect it to what they enjoy and I was excited to go into my room and have a whole shelf full of manipulatives, things that I covered in college. I'm like, "Wow!" I'm so excited to start using them and constantly thinking about math centers, activities and software that I can use for my students. (Int. 2, L. 606-611)

> I was asked if I'd rather teach kindergarten or first grade, and I said, "Kindergarten" because that's the first experience, that's the beginning of their school career, and I want to make a positive influence on their outlook of school. Looking back in my early elementary career, I enjoyed it, I enjoyed math, I enjoyed school, I loved school and I just want for my students to feel the same way. I never want them to feel the way I felt about math. (Int. 2, L. 617-622)

> Faith relived her own emotions about mathematics as she tutored a sixth grade student: I'm kind of seeing myself in a little boy that I'm tutoring. He's in sixth grade and I'm feeling challenged by him because he absolutely hates math. He loves science, but he hates math. His confidence is so far gone that I'm having a hard time trying to build him back up. I told his mother the other day that we were just going to have a fun day of tutoring, and I read a book about fractions with a Hershey bar and let him eat the Hershey bar and then we made a fraction fringe [paper mathematics manipulative] and just tried to make it fun for him. I guess I'm also trying to make a connection with him and try to build up his self-esteem because I see myself in him so much. (Int. 4, L. 464-468)

I asked her if she knew what made him dislike mathematics so intensely. She replied:

> I think just not being able to comprehend it the same way that I did. You just get so frustrated because it's just if you miss one step the whole problem is wrong and I think he just gets frustrated and maybe he has had a bad experience with math. But he also, I was trying to talk to him about it and I don't understand, he's getting pulled out for band and missing math class so maybe that's why he's having such a hard time, he's getting pulled for band…I think it's like a couple of days a week and they said that the band has a yearly concert where they get evaluated and they were pulling him out more right before that happened. I just couldn't get over that they didn't have some kind of schedule where they didn't have to do that. (Int. 4, L. 472-477, 481-484)

Despite Faith's unfortunate experiences with mathematics in public school, her goals are to learn and improve the ways that she teaches mathematics, as well as all other subjects:

> Of course I'm constantly wanting to know more things that I can do with my students and I plan on attending any conferences that are available, I'm going to pursue my Master's degree, and just constantly wanting to learn more about how I can help my students and reach them in different ways. To help those students who struggle and also, how to help those students who are gifted, to challenge them as well. (Int. 2, L. 636-641)

*Reflections on the Life Story*

After I had completed the Faith's life story, I asked her to reflect on what effect telling and reading her story had had on her teaching. She responded by email on July 8, 2005:

> My classroom teaching has been positively impacted by telling and reading my own school story. I did not realize how important it is to relate to the students and for them to feel comfortable before the learning process can even begin to take place. The good and the bad school memories all came back to me from participating in this project. I discovered that I learned so much more from a teacher that I really liked and respected and was willing to work harder to impress that teacher.
>
> This project has helped me to reflect on my school experience so that I can make my students' experiences fun and pleasurable. I feel it is very important to earn the students' respect and admiration. Also, it is important that the student does not feel scared to approach the teacher and ask a question. I want my students to feel comfortable and not afraid at school. Once the students are comfortable and safe, then I believe it is time to make learning fun! Some of my teachers were able to make learning fun and exciting and those are the teachers I will never forget. I want my students to wake up and feel excited about coming to school. My goal is for my students to tell their peers what they learned at school and how much fun it was!
>
> Participating in this project has helped me to step back and reflect on my first year of teaching. Next year there are a lot of things I plan on doing differently in my classroom. However, my level of enthusiasm and eagerness to teach has only risen. I am very excited about getting to know a new classroom of students. I hope that none of my students will have to experience what I did in middle school. I would love to be able to protect them throughout their school experience, but I know that I must let them go at the end of the school year. I can only hope they continue to love school and to love learning.

Faith will begin her second year of teaching kindergarten in a small rural school in Appalachia this coming fall, and from all the comments I heard about her from her principal, fellow teachers, and the parents of last year's students, she did a wonderful job by holding high standards for all the students and by teaching them in a very caring and encouraging way.

*Synopsis of Mathematics Learning in Appalachian Public Schools*

Faith's life story, shared over four interviews and through artifacts such as test data from public school, a chart she completed of school memories, and the graph of her confidence and ability in mathematics, demonstrated a love of school in general combined with a fear of mathematics. This fear began in the upper elementary grades and followed her to college, despite subsequent successes in mathematics courses. Viewing her mathematics education through the lens of the Appalachian culture reveals family closeness, school and teacher quality issues, and an awareness of stereotypes. She overcame the obstacles to her learning and is now a successful early grades teacher, sensitive to shy students like she once was.

After attending preschool where she did mathematics activities and learned other school skills, Faith entered kindergarten ready to learn. According to her self-drawn graph (Figure 2), mathematics was "Wonderful" in grades K-3. Her memories of fun and interesting projects in those years did not include anything specifically mathematical except learning multiplication tables in third grade. In fourth grade, however, math was no longer "wonderful," just "okay".

She recalled that even though they worked in groups, which she enjoyed, the mathematics consisted of drill and practice, textbook-oriented work. She explained, "I'm a person who has to see and feel it before I can comprehend it…. That's when I started just to not really like math as much as I did" (Faith, Int. 4. L. 20-21, 24). In a study of 364 K-12 mathematics and sciences lessons, Weiss and Pasley (2004) found that "compared with lessons taught in suburban and urban schools, those taught in rural schools tended to be lower in quality on such key indicators as intellectual rigor and sense making" (p. 25). When mathematics lessons consist primarily of drill and practice, neglecting to engage the student in sense making, conceptual understanding suffers (Weiss & Pasley), and in Faith's case, her attitude toward mathematics.

From fifth grade until graduating from high school, Faith indicated on her graph (Figure 2) that she hated mathematics. In fifth and sixth grade, her dislike of the mathematics class was compounded with discipline problems and incompetent teachers in the entire school so much that she felt afraid to be there. Faith had the same teacher for both fifth and sixth grade mathematics who emphasized speed and competition at the chalkboard. "The teacher would give you the question and whoever wrote it down the fastest and solved it fastest was the winner" (Int. 1, L. 26-27). Because Faith was one of the top students, she was "devastated" if she didn't "win the challenge" (Int. 4, L. 36, 37). A continuing classroom practice that puts students in conflict rather than a climate enhancing relationships and cooperation takes time away from meaningful mathematics instruction and results in a sense of alienation for many students especially females, shy students, and students in poverty. (Lim, 2004; Payne, 2001; Stipek & Gralinski, 1991).

Although Faith loved all her other subjects in the school she attended for grades seven through twelve, she continued to hate mathematics, dreading it and was afraid to be called on. Her mathematics teacher was her basketball coach, but she did not recall specifically what they did in that class. Faith described her ninth grade Algebra I teacher as "just horrible" (Int. 1, L. 752), teaching above their heads, even enjoying being the "difficult" teacher. He also tended to flirt with the girls and "he just had his picks" (Int. 3, L. 123). Throughout her junior high school years, Faith continued to work in mathematics class and make good grades, yet learning little about mathematics except that it is based on speed and ability. In a study on females' experiences in mathematics classes, Lim (2004) found that the "authoritative and competitive culture of the math classroom was found to be the primary source of the pervasive anxiety or self-alienation among the participants" (p. 51) and that "helplessness and deep-seated anger prevented [the girls in the study] from achieving a genuine understanding of mathematical knowledge" (p. 52).

In tenth grade, Faith took geometry, a subject she did not expect to do well in even though she had an "excellent" (Int. 2, L. 284) teacher. In a fatalistic manner, a possible aspect of the Appalachian culture (Weller, 1965), Faith believed that she was successful at algebra and therefore would not be able to do geometry. She considered algebraic equations as "not quite as mathematical" (Int. 1, L. 321), so in eleventh grade, "Algebra II just came easy, it was like the light bulb clicked. It turned on" (Int. 2, L. 304-305). Perhaps feeling more comfortable with the rule-like procedures (Chazan & Yerushalmy, 2003) caused Faith to favor algebra. But her struggles with geometry could have developed from a number of directions including poor instruction in geometry class (Clements, 2003), attribution to ability (McLeod, 1993), or gender differences (Clements & Battista, 1992).

Faith had signed up for Trigonometry, but dropped it, so Algebra II was the last mathematics class she had in high school. "That was my mind set; I was going to avoid it" (Int. 3, L. 157). "I loved learning, and I loved doing homework, but I just hated math" (Int. 1, L.

215). As Bottoms and Carpenter (2003) reported in *Factors Affecting Mathematics Achievement in Rural Schools*, "These schools fail to provide many of their students with the levels and kinds of experiences, such as guidance, extra help and support needed to enter and succeed in higher level mathematics courses." (p. 2). Faith recalled very little encouragement from her guidance counselor to take higher level mathematics classes. "No one every really connected it to college" (Int. 3, L. 155).

Impacting Faith's mathematics learning more than the Appalachian culture was the rural poverty of the region in terms of several years of poor teacher quality and lack of available financial support for well apportioned schools and extra academic programs (Bush, 2003). The gender bias that Faith experienced overtly and covertly may have been a bit more acceptable in a male-oriented society like some areas of Appalachian (DeYoung, 2002). In addition, an Appalachian sense of fatalism (Weller, 1965) could have contributed to Faith's belief that she just did not have the ability to do geometry.

Faith was aware of the negative Appalachian stereotype, but that knowledge motivated her to prove it false. She had a high school class on Appalachian literature which honored the region and her family's participation in coal mining. Perhaps a characteristic tie to place (The Rural Youth and Families Consortium, 1996; Weller, 1965) influenced her choice of a college near enough to her home that she could commute. Her close ties with her family (The Rural Youth and Families Consortium, 1996; Weller, 1965), their support, and the values of hard work and perseverance that she learned from them enabled her to succeed in school despite the obstacles that she had to face in learning, especially in mathematics. Faith was able to reach her goals as a college graduate who is beginning a master's degree program and her second year of teaching in elementary school, a job in the area which she loves.

# Chapter Six

## Peyton's Story

I knew Peyton as a recent graduate of the small private college in Central Appalachia where I was an adjunct instructor. I had seen her occasionally with her good friend in our teacher education program and talked with her on numerous occasions about considering education, but she became interested in teaching after she began to work as an instructional aide in an elementary school and through the encouragement of others. She enrolled in a graduate program at a large university offering teacher licensure through local and distance learning courses. As part of the requirements for full admission to the graduate program, Peyton was required to take the *Praxis I* tests in reading, writing, and mathematics, and make the minimum score required for teacher licensure in Virginia. She took the *Praxis I* tests for the first time in the fall of 2001, without meeting the minimum requirements on any of the three parts. Knowing that I had tutored others in preparation for the mathematics portion of the *Praxis I*, she asked me to help her. Beginning in January, 2002, I began to work with her to review mathematics skills and topics in preparation for the test. She passed the *Praxis I* – Mathematics test with the minimum score of 178 in March 2003.

Through the fifteen months of our work together, Peyton dedicated herself to learning the mathematics, completing any assignment that I gave her including all the problems in *1001 Math Problems* (Tarbell, 1999). In our conversations, I often questioned her about her mathematics and school background because I wondered how a college graduate with such apparent dedication to learning could not have the mathematics skills needed for a basic competency test. I also wanted to develop the most efficient methods of test preparation for the mathematics test. During this time period, I researched issues surrounding the *Praxis I Assessment,* and I discussed my findings with her. As a result, she became interested in researching her own mathematics background and agreed to be the participant in a pilot study. The extraordinarily active role that Peyton assumed in this study made me view her as a partner interested in discovering the source of her own difficulties with mathematics and searching for answers beyond what I asked of her. Since I began my dissertation, my research questions had shifted from an emphasis on difficulties with the *Praxis I Mathematics* test to exploring the public school experiences of individuals form Central Appalachia within a life history approach. I asked Peyton in March, 2005, for an additional interview, and she readily agreed.

### *Current Status*

Peyton is a 28-year old Caucasian female, born and raised in Central Appalachia. She holds a bachelor's degree in business from the small private college where I teach and has begun taking classes in a master's degree program from another large university, seeking a teaching license for elementary school. For 3 years, she was employed in the local school system as an instructional aide, and is currently continuing her graduate work while working as a substitute teacher.

Following the time that I tutored her, after the pilot study, Peyton and I would visit periodically by telephone, or in person, to talk about her coursework and her teaching situations. But during the 4$^{th}$ formal interview, I asked her to draw a graph or chart of her self-assessed confidence and abilities in mathematics during her years of public schools. She used a scale of 1

to 8 with “a bad year...ranking the lowest...a 1” (Int. 4, L. 329). Reflecting on the ups and downs of the chart she had constructed, Peyton said:

> I feel thankful for the good years which averages maybe half, but that’s really not half. For the other years, the real bottom low years, you feel kind of sorry. You feel, “How could this have been changed?” “What could I have done differently?” Maybe a more active parent could’ve stepped in or a more active teacher. If it was different what would it look like then? Would you see something more straight across, would it be more up near the top of the chart? (Int. 4, L. 475-480)

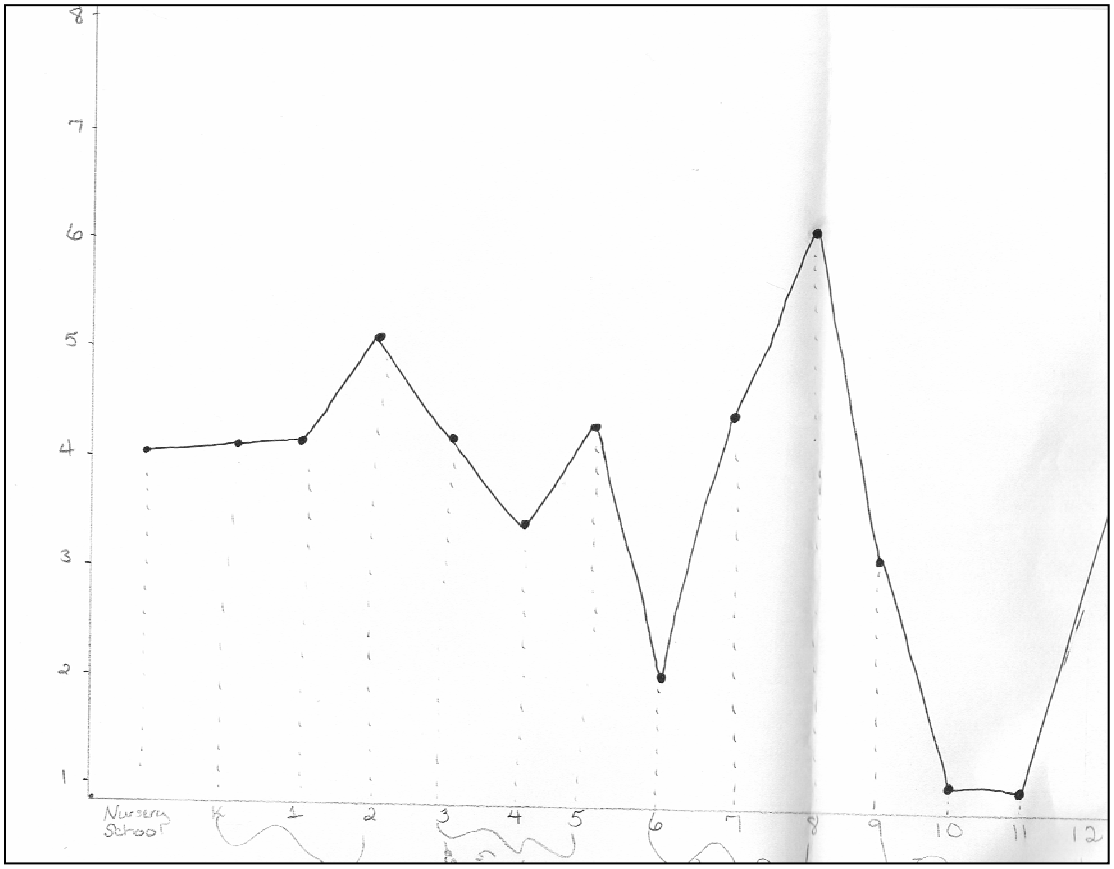


**Figure 3:** Peyton’s Chart of her Self-Assessed Ability, Achievement, and Confidence Level in Mathematics for Each Year of Public School. The scale ranges from 1 to 8, with lower numbers indicating less self-assessed ability, achievement, and confidence.

*Pre-Kindergarten*

Peyton attended nursery school at Hilltop Baptist Church in town for a year and a half. She remembered her mother taking her for the first time:

> I think maybe when we interviewed with Ms. Roney [the nursery school teacher]. I’m not sure how we ended up there, but we were there, and she was talking with my mother. And I went over, and they had a little kitchen set up, and I was just playing away as they were talking and she, even at that point, came over and explained how to set the table properly. Even that early on. (Int. 1, L. 354-358)

Peyton enjoyed this first educational experience and believes that she learned a lot. “I loved to attend school. We made crafts, sang songs, went on field trips, picnics, visited the library, etc” (School Information Questionnaire). Some of her lessons focused on mathematics skills. “We learned basic counting skills while learning how to set the table and counting blocks” (School Information Questionnaire).

*Primary School*

Peyton attended Spring Creek, a tiny country school farther down the valley from where she lived, for kindergarten through second grade. Classes were tiny, 15 students or less in each. In kindergarten, she remembered writing her numbers, and watching *Sesame Street* on the public television channel; she recalled seeing an eclipse during that year and the rewards of being a good student.

> In kindergarten, I remember we were actually allowed to take naps and the little blanket that I had there, it wasn’t a blanket it was like part of a quilt square big enough for a little kid, it had a Care Bear on it and I even learned then that if you laid really still you didn’t have to fall asleep but they’d still stamp your hand…Like you were good for the day. (Int. 3, L. 536-540, 555)

In first grade, Peyton had one of her “best” teachers, Ms. Havens, who was “very caring” (Int. 4, L. 189):

> There were some, like the first grade teacher, that just by looking at the names [of all my teachers] here on the questionnaire; she stood out above all of those. Could be because she was younger at the time, I think too it’s just her personality…I still think by being younger and by introducing different concepts and making learning fun helped the first grade teacher. (Int. 1, L. 452-457)

Peyton’s memories of second grade included the space shuttle, *Challenger*, which exploded killing a teacher, Christa McAuliffe.

> Starting with 2nd grade, the teacher was almost like a good friend looking back on it. She would invite you to her desk, you could actually read her clips out of the newspaper and she would give you awards. She was just so outgoing just so trying to have you to fit in, have you to be a part of everything. (Int. 4, 452-455)

Peyton had a different impression of her teacher in terms of academics:

> Also in 2nd grade Mrs. Patton, and from what I’m remembering it was not such a great year that year, maybe she didn’t cover the materials that she was supposed to because in 3rd grade we kind of spent that year catching up from 2nd grade. (Int. 4, L. 200-203)

Peyton included some notes on the questionnaire about her primary school experiences that her mother had told her about:

> My mother remembers some of the teachers not being able to get the information through to me. She questioned if the early elementary teachers were qualified to teach grades 2nd and 3rd. She remembers one conference where the teacher approached her and stated that I had flunked a test, but she knew that I understood the information. My mother also stated that I was a bright child and that she would get me a tutor if needed to get the information through. In addition, she stated that she would take me to the bank and hold me up to the counter to make deposits. (Int. 4, L. 200-203)

Comments on the report cards from her teachers were favorable: "Peyton is a joy to teach. She is progressing nicely." (First Grade) and "Peyton is a joy! She works very hard" (Second Grade). Her grades in mathematics reflected progress, B in first grade and A's in second grade.

*Intermediate School*

For grades three, four, and five, Peyton rode the bus to Stony Dale, another small country school. She described their location:

> Spring Creek was further down in the valley and Stony Dale Elementary was closer to a little local store. Another difference is Stony Dale had the trailers. In the trailers was the library and also the Title Reading. (Int. 1, 420-423)

Peyton favored the small class sizes in her elementary schools, especially in light of her current work in public schools:

> When I was school age, I didn't realize how important that [a small class size] was because in most of the classes Kindergarten through 5th grade, even though it was two different elementary schools, there were less than 15 in the class. And now you have at least 25 maybe more. So you had more individualized attention and even if you had a problem in math or whatever subject, the teacher was able to address it. And she probably knew your mother by name and could call her on the phone. But both of these schools, Spring Creek and Stony Dale Elementary, were both, looking back, diamonds in the rough. (Int. 1, L. 395-402)

The small class size and closeness of the schools to the community could mean that they were able to provide individualized attention in mathematics, but that was not always what transpired:

> As a whole, some [years for mathematics in the elementary grades were] between O.K. and not so good, that would have to be the majority. Even though the class sizes were small there was still something I was not getting, something not being addressed, whatever the issue…I think even though [my elementary school years were] a growing time, some of the potential was lost and probably now has been picked back up since we have studied so hard on math [during the tutoring for Praxis I]. But that, at that time, was lost because maybe I didn't receive enough practice or just the right information to know what to do. (Int. 1, L. 465-467, 473-476)

When I asked Peyton how she viewed herself as a student in mathematics in elementary school, she answered:

> Probably average slash struggling. Probably because being in a small classroom you're going to have at least 2 or 3 kids that rise above, and I think I was always somewhere in the middle range. In other subjects, I was probably higher. Just struggling to understand and grasp the concept being taught. (Int. 2, L. 441-444)

In third grade Peyton remembered that she "struggled with multiplication facts" (Questionnaire) and studied them at home:

> Also learning the multiplication tables was extremely hard and the way I learned that was my father. I recorded him saying those over and over, and then I would listen to it. I actually memorized them instead of learning them…Memorizing you learn it for a certain period of time, rather it's a test or a quiz. Learning it, you know it and if someone asks you a month or a year from now you still know it. It's always there. If it's like with math and learning how to do a problem, you could always show other students how to do it where memorizing you may overload and then forget. (Int. 4, L. 227-229, 233-237)

On her report card for third grade mathematics, Peyton received five B's and 1 C and her teacher commented, "Doing nicely: Keep working, Peyton."

Fourth Grade brought more challenges as demonstrated by the drop on Peyton's graph (Figure 3), one of which was homework: "Some math assignments I remember others not turning in that I would turn in, even though I may have had the wrong answers" (Int. 4, L. 305-306). She also recalled:

> What I tried to do [when making the graph] is still go back to what I thought of per grade and how things were taught. The memory that comes to mind is in fourth grade; math was so hard. Even with the homework assignments, I would take them home, and I still could not understand them. I would go to class or to school the next day and still the problems would be wrong so that really the help from home was not really helping. (Int. 4, L. 19-24).

> I remember in 4$^{th}$ grade, I struggled with the homework so much. We were given a large assignment, and there was only about 2 of us that did the work. I think everyone else had just gave up on it. Even then my father would sit and try to drill and drill and drill and it would just not go in, even on up into middle school. (Int. 2, L. 424-428)

Peyton also associated fourth grade with word problems and remembering those brought strong reactions:

> I absolutely hated [word problems]. I remember those in 4$^{th}$ grade, too. The teacher would assign problems and I just could not, it could have been before 4$^{th}$ grade but this one sticks out, I could not remember from what the problem said to write it down on the paper. It would go through and not even stick (Int. 3, L. 194-197)

> [We did problem solving in] probably maybe every other grade. So maybe you would hit a year and then miss a year. Maybe, because I know I remember 4$^{th}$ grade doing word problems and I absolutely hated them…I had these and I still have them somewhere, you

> made little keys and they had like addition and subtraction and it was words that would tell you addition means this and subtraction means this. Those helped. I think probably what would have helped is more practice. (Int. 2, L. 321-322, 326-329)

Even though Peyton showed effort in her school work, "You know, I did study, but fourth grade kind of hit hard with math" (Int. 4, l. 204-205). She remembered another challenging mathematics topic, "I had a very hard time with division. [The teacher] would assign extra work, and my father tried to help me" (Questionnaire). In retrospect, "I think maybe the brick wall [of lack of understanding in mathematics] started to be built in like fourth grade. I can remember still having trouble, but it wasn't too much trouble" (Int. 3, L. 89-90).

Despite these worries, her fourth grade report card shows mathematics grades that were three B's, two C's and two C's, and a positive, yet vague, overall comment, "Peyton is a very good student. She works hard. She has an attractive personality." The standardized test she took in March of her fourth grade year showed acceptable progress in mathematics with grade equivalences (in years-months) of 4y-6m in concepts, 4y-0m in problem solving, 6y-5m in computation and an acceptable 5y-0m in total mathematics. Peyton also received remedial reading services at school for that year only, and constant reading encouragement at home, "I also was reading the newspaper at my grandmother's house. We would read books together, so there was a little extra work going on at home" (Int. 4, L. 206-207). Because she enjoys history as an adult, Peyton also noted, "We also studied Virginia history that year" (Questionnaire). "Then I did enjoy other subjects that year, one was Virginia History that I just would have done all day if they would have let me" (Int. 4, L. 306-308).

Fifth grade brought a slight improvement in Peyton's mathematics self-assessed abilities and confidence as shown by her graph (Figure 3). She had few specific memories, recalling:

> This teacher was very tough. I never understood it, but her children attended [a private] school. Anyway, she assigned us a lot of work because a girl kicked a boy in a private place. (Questionnaire)

The mathematics grades on her report card showed a slight improvement over the ones from fourth grade with four B's, one C, and one D, but there were no teacher comments. Peyton took a standardized test again in March and scored above her grade level in mathematics with grade equivalences (in years-months) of 6y-0m in concepts, 6y-7m in problem solving, 6y-9m in computation and 6y-5m in total mathematics. Peyton remembered when the fifth grade students at Stony Dale were introduced to the middle school that they would attend as sixth graders:

> We visited the middle school for the first time. I remember that when our school was called out I stood with pride because there was only 13 of us. (Questionnaire)

*Middle School*

Going from a tiny country school to a consolidated middle school was understandably difficult for Peyton: "Middle school was a very hard change. I did not care for it" (Questionnaire). In addition to class size, Peyton had to deal with seven class periods a day after being in a self-contained classroom. Nevertheless, she was elected "Student of the Month" in that sixth grade class of over 200 students in only her second month in the middle school. She was

able to enjoy additional activities, too. “In middle school you just think of different experiences. One is in PE class, running the mile; you also think of band class” (Int. 4, L. 208-210).

The mathematics class in sixth grade, however, produced a different reaction from Peyton: “She [the sixth grade mathematics teacher] was a horrible teacher. I understood very little” (Questionnaire). I asked Peyton if the difficulties with mathematics were the result of the school change or the teacher’s methods, she answered, “It related some but wouldn’t have been that big of a factor going to a different school. The majority of that was the math.” (Int. 4, L. 367-368). Peyton also considered the difficulty of learning mathematics from this particular teacher:

> I think some of both because coming from the smaller school you realize, you know, hey, there’s 150 or 100 other kids out there. It’s not just you. Part of it was the teacher. She lacked the skills, I think, to just get the concept across. Just to give you a concrete knowledge of what was going on. (Int. 1, L. 501-504)

> I was sitting in the back, which I think was another wrong mistake. I would always watch the clock on the wall. Her desk was against the window, and she would show a problem or two on the board. Then you would have some class work and then homework after that. So just not really making learning fun. (Int. 1, L. 509-512)

Peyton thought about other aspects of the sixth grade mathematics class which may have caused “a new layer of bricks [to be] added” (Int. 3, L. 91-92) to her mathematical difficulties, “looking to the previous year, which was fifth grade, there was just a drastic drop” (Int. 4, L. 384-385):

> She [the sixth grade mathematics teacher], for one thing, could have taken more of an interest. Even though I realized teachers have, you know in middle school you’re going to have at least a hundred kids a day. Offer some kind of after school or before school tutoring, anything just to provide extra support… she didn’t have a relationship with everyone. (Int. 3, L. 96-98, 109)

> Usually I would take [the homework] home and then hope somebody, either a family member would know, or I would just hope someone could help me. (Int. 1, L. 539-540)

> ...it could be because [the mathematics teacher’s] husband was in a political office on or around that time, [that] could have made her have that attitude [of being unapproachable] and true, you can ask any of those people that I had, I was a very shy person. I really didn’t speak out like I do now. (Int.3, L. 618-621)

> In sixth grade, [the mathematics teacher’s] husband had a prominent job in the community, so she was well known. What ended up happening there was I had math 7$^{th}$ period and by the end of the day, yes, you’re tired. And I did sit in the back of the room that year, but there were only maybe a dozen students. So you were spaced every few seats. She still didn’t, in my opinion, explain the material well enough for me to understand it so by that time you’re almost let’s say two years behind in math, if you’re counting back to fourth grade, but somehow I still managed to get the average grade. (Int. 4, L. 36-41)

Peyton's report card reflected acceptable grades of five B's and 1 C in sixth grade mathematics.

The graph of Peyton's self-assessed mathematics abilities (Figure 3) showed a slight increase after the low point of sixth grade. She recalled her impressions about seventh grade mathematics:

> Math was still a struggle. The student teacher during this time worked with me, but I still did not get it. The teacher was actually good. (Questionnaire)

> Math was still just a struggle. The teacher was younger at the time, made learning fun, so you went from one extreme to the other…Probably because the background wasn't there. Or not strong enough. (Int. 1, L. 546-547, 552)

> Maybe not extra help, I know that you could ask questions but not anything after as in going back after class. It was still the [seventh grade mathematics] teacher [who] explained more and [that] teacher was younger and you could understand. (Int. 4, L. 430-432)

Peyton's grades in 7th grade mathematics were five C's and two B's on her report card with a comment from her mathematics teacher, "Peyton is a very hard worker." She remembered one subject that she really enjoyed. "I still, this started in fourth grade, still had this, we'll call it a love for history. So even in 7th grade, history sticks out in my mind" (Int. 1 L. 567-569).

Eighth grade was the highest point on Peyton's graph (Figure 3) in all the public school years, showing a high self-assessed ability and confidence in mathematics.

> So eighth grade math looked a little brighter. The teacher that year, he explained the concepts better. He even provided where you could do extra credit in the class, which I did take a part in, where you could actually teach a lesson to the other students. That was Pre-Algebra even though it was kind of hard and very new from everything else, from the basic math that you were learning before. (Int. 4, L. 42-46)

> Elementary to middle school was a struggle so it was kind of dim at that point. But if you hit a year like eighth grade year where you have the good teacher the light bulb was fully on. It was almost an on again, off again. (Int. 4, L. 102-104)

> Looking at 8th grade [mathematics], the teacher there made learning fun. He didn't, he wouldn't necessarily stand in front of the classroom. One day he taught from the back of the room, one day I think he stood on his desk. Just little things like that to keep you involved and to keep you in tune with what was going on. (Int. 4, 460-464)

> Any good math memories? Eighth grade was good, and I think the majority of that was from the teacher and how he explained. (Int. 4, L. 212-213)

> I was making up for lost time during this math year. I understood some of the concepts. I actually taught a lesson on positive and negative integers. (Questionnaire)

Peyton remembered a lesson on positive and negative integers in the eighth grade as the only time she ever made a presentation in a mathematics class:

> Another presentation, which is related to math, was in 8th grade, and I actually taught a math lesson. It was for extra credit. So Ms. Franklin, I went to her house the night before and she told me how exactly to go over it. It was actually multiplying and dividing positive and negative numbers…I really liked it. I probably went very fast because growing up I was very shy and nervous and I didn't want to talk to anyone, just select family and friends. I do remember one girl, Gina; she raised her hand. I think I even asked if there were any questions. She said, "Now to do this, you do this?" and I remember saying "Yes, that's how you do it"…I think it was [a good idea] because I was on the receiving end of the extra credit points. But maybe too, also on the other hand, if one particular student was looking for a career choice and maybe would see teaching as an option. (Int. 2, L. 285-288, 292-295, 299-301)

> The eighth grade pre-algebra class, that's where I taught the lesson that I remember...It was on the integers…I did (know) it… [I'll] toot my own horn. (Int. 3, L. 278-279, 283-287)

An effective teacher and a good year in mathematics, including one A, four B's and one C on her report card, could not entirely compensate for the other years, as Peyton explained:

> I don't think once you have either one bad year, two bad years, whatever it might be, you still, you never really catch up. You're still always somewhat behind even though you may have good teachers from middle school on through high school. That one year there may be some concept, anything you needed that year and still didn't get. (Int. 1, L. 571-579)

Peyton assessed her progress in mathematics during all of the middle school years: "[In grades] six to eight, [math] became very much harder, so I probably took a step from average, maybe not below average, what is the right word?" (Int. 2, L. 450-451) A standardized test in March of her eighth grade year showed her to be at or above grade level in mathematics with grade equivalences (in years-months) of 9y-0m in concepts, 8y-6m in problem solving, 9y-1m in computation and 8y-9m in total mathematics.

*High School*

Peyton took Algebra I as a ninth grader in high school, and although her self-assessed mathematics ability dropped considerably (Figure 3), she remembered "I actually did pretty well in the class" (Questionnaire). The grades on her report card for that year-long course affirm her recollection, one A and six B's with a positive teacher comment from her algebra teacher: "A pleasure to have in class." However, she does not attribute her success to the class, itself:

> [The Algebra I teacher] was O.K. in being effective. She was an older lady and even the story I remember from that grade, [is that] people would pull pranks on her and things like that so I think what helped that year was the background from 8th grade. (Int. 1, L. 592-594)

She remembered little else about the class except that it was the son of a prominent community member who "pulled pranks on this lady all the time," and that Peyton "fell asleep in her class because it was so boring one day" (Questionnaire).

The next two years of mathematics in high school were represented on her graph as the lowest points in all her public school years (Figure 3). In tenth grade, that class was geometry. She remembered struggling with the concepts and not being allowed to use a calculator:

> This was a very tough class. I had a hard time understanding in this class. I did not like that we could not use calculators. (Questionnaire)

> This particular year, I sat in the front of the class. In most high school [classes], if memory serves me correctly, we could always choose where we sat. Even struggling in middle school early on, my mother would say "Sit in the front so you can see the board and pay attention." I would try to do that but still geometry was just, I didn't have a knack for it. (Int. 1, L. 626-630)

> That [geometry concepts] sticks out because of the class in high school where it was geometry with all the figures, and the formulas and what's congruent to this….That was the same year where we couldn't use the calculators so I guess I was mad the whole year about that. No, it was just very hard. I never, I'll tie in all this to memorizing, I would try to learn and memorize, but it still wasn't there. (Int. 3, L. 226-227, 232-234)

> I was still in the front of the class, I remember sitting right next to the door. And on the particular test I'm remembering you had, it was Geometry class and formulas, and you had the figure at the top and the paper was divided in half, and she would list the few steps on one side and you had to fill in the other side. She would not allow you to use calculators, but even then the explanation from the teacher, looking back, was key in part of this [difficulty with mathematics in tenth grade]. (Int. 4, L. 56-62)

Peyton also remembered that there was a lot of time in class that was not used for learning geometry:

> Looking back I do remember some free time in [geometry] class. I was French braiding a classmate's hair and then, by looking at what someone had written in the yearbook, we still had more free time. I also remember I had a cousin a year older in the school and she had the same teacher but for another class and why this sticks into my memory I'm still not certain but anyway she was checked out by her first husband. He came in and checked her out from class so for whatever reason that goes with it. (Int. 4, L. 125-131)

> Probably about, this is just a guess, eighty percent [of class time was] maybe not really doing what you're supposed to… I remember not liking it even though I enjoy school. And it can be the worst day ever and the worst class, but you know in the next hour that you're going to be somewhere else that you enjoy. So you kind of weigh the good with the bad. Also this particular teacher, a couple of years later I had her [relative] for class, and you could actually get extra credit in this lady's class and that was by, when she got

> married, clipping the local announcements out of the paper and bringing those in for extra points. So, of course, I did that. (Int. 4, L. 148-149, 164-170)

I asked Peyton if her struggles with geometry were the result of previous problems with mathematics or if it just seemed to be a difficult subject. She replied:

> Some of both. I still think once you have a bad teacher one year, no matter when it is, that still has a great impact. It was just so hard, I don't think I had ever, even though nursery school and things like that [when] you work with triangles and you know the shapes, but it's just all those formulas and what's congruent to this and equal to this that and the other. (Int. 1, L. 635-639)

The other point sharing the lowest position on Peyton's chart (Figure 3) represented eleventh grade Algebra II, her last high school mathematics course.

> This [Algebra II] teacher, in my opinion, lacks the ability to teach. She did not explain anything. I made a D the first six weeks. My mother had a cow. The teacher was also known for her drinking. (Questionnaire)

> In this particular year, after having no calculators in 10$^{th}$ grade, I was just thrilled that we could have a calculator. I was still sitting in the front; she was known for using the overhead projector. She would do a few little notes or show a problem or two on there, and then if she didn't use that on a particular day, she would usually write on the board. And then she would just assign work. Well the practice and what she was she was doing was just usually not enough because I know I made a D the first six weeks… She didn't explain it clearly, I don't think. Because I know that particular year I did have a tutor and I could say, "Explain this," and the tutor would explain it, and then I would just get it. (Int. 1, L. 699-705, 714-716)

> Then high school math, two particular teachers [geometry and Algebra II] come to mind. And it's hard to see the difference between the two because they almost run together. The first lady was known, she did use the overhead if I'm remembering correctly, but still no explanation of what to do. What ended up happening there is the first six weeks I had a D. So my mother called her or she called my mother somehow, which ever way it went, so then they decided I needed a tutor. Then the tutor was there so grades came up which was always better, but still there was really not the visual explanation from the teacher or what should have been going on never did happen. (Int. 4, L. 47-55)

Peyton compared the teachers of the two lowest points on her chart, "They were similar because you were struggling both years with the concepts being taught, even though it was two different teachers, and even though it was math, it was two different types of math" (Int. 4, L. 340-342).

Peyton did not take a mathematics course in her senior year and her view of herself as a successful mathematics student in high school reflected that choice:

> Probably, in math classes, [I was] still a step below average but not below average. With only taking math 3 out of the 4 years, I think that was one downfall there. Then some of

> the teachers, even though the subject may have been hard, they didn't have their acts together either. (Int. 2, L. 465-467)

The year-end grades for geometry and Algebra II were both B's.

Except for mathematics classes, Peyton enjoyed high school, participating in activities and accepting challenges:

> Looking at high school English, I know this is way off of our math topic, 9th grade I think I was probably in an average class and I did so well in that class that the next year, not with the gifted students but with the more advanced. But I still, that year I struggled. I went from being like straight A's, I still had good grades but it wasn't that good, so then 11th grade year it was like back to an average group and 12th grade it was average. (Int. 3, L. 33-37)

> You know [I was] always involved in different clubs and so forth. Driving to school and things like that. So it's, you know, as you grow older, it's changing and you're adjusting to it…I was in Thespians, BETA [an honor and service organization], FBLA [Future Business Leaders of America]. I think that's all… I played the clarinet. (Int. 1, L. 652-654, 658, 662)

> I did think of, going way back to high school, one of the high school business teachers, she said, "Why don't you be in a pageant? The Miss [name of high school] Pageant?" and I said "O.K". So ended up, I was in it and I placed [in the top 5] and I was Miss Congeniality. That was another [memory]…It was some of both [scary and fun] because I remember being on stage, and you don't see the audience you just hear these noises out in the crowd. (Int. 3, 412-414, 418-419)

In addition to classes and clubs, Peyton had the opportunity to do work-study for one of the business teachers:

> I'll do some background [of the work-story], and then I'll answer the benefits. The particular teacher, I had her for two [business] classes during that year and she had an opening. And she said, "I realize that you are in band and usually we hire students and they work during the school day, but I'll let you do a work study, just ask your mom and make sure it is O.K." So I asked and she said "O.K." So I ended up; I would either go in before school or stay after school and work. I graded her tests. If the copier broke down, I would fix it, just anything. And I would get paid for it, and I was issued a check from the county... So the benefit was, I realized you know, hey, you are gaining a skill that you can at least put down on a resume at some point in time. (Int. 1, L. 177-186)

Peyton's success in high school was confirmed through various awards; she remembered receiving a business scholarship, the [local name] scholarship, and a banking scholarship for college. In addition, she entered a social studies contest and won a $1000 scholarship with a research project resulting in a leather book with three sections of information on Stonewall Jackson, his wife, and a soldier in his camp.

*More Insights about Public School*

In addition to her attitude and work ethic, Peyton's attendance records were remarkable. From the available report card data, no absences were recorded until 1 day in the 10th grade and 2 days in the 11th grade. Peyton remembers missing only one day in elementary school for chicken pox and estimates she probably missed less than 5 days in high school. This is particularly interesting in that the middle and high schools were in town, and Peyton lived out in the country about 20 minutes from the school. She had to ride the bus, and in later high school years drove her parents' truck to school.

Peyton was always conscientious about her homework, so much so that the other children called to ask her about it:

> Even though I was frustrated, I would still do it. I remember in elementary school … it was so small that all the children knew everybody and knew everybody's parents and sisters and brothers and family and so forth. Children in my class would call me and ask me what the assignments were … Even in high school, they would call, "Now what do we have to do?" (Int. 2, L. 391-394, 398)

> Also I have some cousins that went to a [another] school, and they would always call and ask me how to do assignments because even, at one point, they did come to my school and they kind of went back and forth so no matter where they were they would call and ask me how to do things. One cousin, I actually helped her write her speech when she graduated. She was valedictorian or salutatorian, one of those. (Int. 4, L. 291-296)

Peyton remembered, "I was a very shy person. I really didn't speak out like I do now" (Int. 3, L. 621-623). In fact, she attributed it to part of her struggles with mathematics. "If I would have maybe spoken more, it would have helped. You blame yourself some, maybe not 100%, but at least maybe 25% or 50% of it" (Int. 3, L. 634-635) Peyton commented that the graph of her self-assessed mathematics abilities (Figure 3) could also be a map of her confidence or reluctance in asking questions:

> [The feelings of shyness can be represented by] almost kind of word-for-word what the graph looks like. Because if you're going along, and this could be a very shy point, and you're starting to come out of shyness and then you slowly creep back down. It's almost like the math reflects to build your self esteem too. (Int. 4, L. 443-446)

When asked about working math problems at the chalkboard, Peyton's shyness didn't prevent her for wanting to learn from the experience.

> I do remember maybe one class, I'm not sure which it was, maybe it was 8th grade math, the teacher would assign, go down the row and you would have problem 1, 2, 3, 4 and that's what you would work on the board. So right or wrong, your answer's up there… At the time, you feel like a little ant. But looking back, it makes you more aware of if that is a problem area the teacher could recognize that and help you. (Int. 2, L. 236-238,242-243)

*College*

Peyton attended a small private college, less than an hour from her childhood home. She married, when she was 18 years old, in the fall of her first year of college, moved closer to the campus and commuted to her classes there. I asked her what she saw herself doing for a living at that point, and she answered, "Working somewhere in the retail market" (Int. 1, L. 205).

> When I enrolled in college, I did not favor many subjects. In high school, I grew to like business, although I still had a passion for history. I majored in business and minored in history. I did not have any degree goals because I feel that I was never led into any specific area. (Questionnaire)

She further explained her choice of business management as a college major:

> The answer is kind of a mixed half and half. The uncle that I previously mentioned, he worked for a business in Ohio for numerous years and then has been transferred since, but is still doing the same job so that kind of maybe a fourth of why I chose business. But I never really had an outstanding subject like math or science, English, anything that stood out, and when I was working as a work study student in high school that kind of played into it because I worked under a business teacher and so was not really 100% sure of anything so I just kind of combined the uncle with his job and the business and went toward the business side…I first thought of retail, possible selling clothes of some sort. But I did try that one summer and didn't care for it. It was too much. (Int. 1, L. 51-59, 68-69)

In regards to learning about choice of major or college requirements at the high school, she apparently had very little contact with guidance counselors:

> Looking at and reflecting on this same topic [the choice of college major], you look at what the guidance counselors did while you were in high school compared with other high schools in the same county. And one of the more prominent schools we're finding looked at more "what you want to do with your life" to whereas [my] high school, I don't remember seeing the guidance counselor. They just kind of sat back in their office and you turned in what you were taking the next school year to them and that was about it. There was not too much more than that. (Int. 4, 297-303)

Peyton extended her mathematics self-assessment chart (Figure 3) beyond public school to include three college courses, and she rated those 8 out of 8, higher than any of the public school years. In spite of the gaps in her public school mathematics background, Peyton was successful in these college mathematics courses due, in her opinion, to a particularly effective mathematics professor.

> Even though it [the college courses] was Algebra I and II and Statistics, the subjects in itself is extremely hard, but coming from a very poor background, meaning $10^{th}$ and $11^{th}$ grade, I was very fortunate to have a very good college professor meaning that he explained and you understood which is why I rated those the way I did…I think I learned more from his methods and also he was a younger teacher…It [The graph, Figure 3] is

> somewhat reflected in kind of the poorer areas ,I guess the ones, 4 and below, some are right at 4. Those it was mostly the math as well as the teacher. The ones that are rated higher, the teacher was more personable toward the students...They made office hours available. They even would stay after and explain if you had questions you could go and ask…Those are answered based on the three college years…Maybe not extra help, I know that you could ask questions, but not anything after as in going back after class. It was still the teacher explained more and the teacher was younger and you could understand. (Int. 4, L. 399-402, 409, 414-417, 421-422, 425, 430-432)
>
> Then college had good math memories. It was also still how the teacher explained, which was three classes there. I had the same teacher. (Int. 4, L. 214-215)
>
> Those [probability and statistics] I remember from college, but that was still the year I had the wonderful teacher in college. (Int. 3, L. 256-257)
>
> I think what helped so much in the college classes was the teacher. Even if you had a poor math background you could still have had this one teacher that I had and you would have understood every concept in each class. So the teacher played an important part. (Int. 1, L. 212-215)
>
> The three years in college I remember the teacher there, even though he met the dress code with what he wore, he would always wear tennis shoes, so you kind of knew he was younger, kind of hip, you could say. He was trying to be on your level instead of one that would just leave you behind somewhere. (Int. 4, L. 465-468)

As a college freshman she made an A in Algebra I, an A in Algebra II, and as a sophomore, a B in Statistics. Although Peyton characterized herself as lower than average in high school mathematics classes, she considered herself average in college mathematics. “I believe ¾ to 90% of that was the teacher” (Int. 2, L. 472-472)

*Praxis I Mathematics*

Peyton took her first PPST-Mathematics test in December, 2001, and was surprised when she did not do well. She wrote:

> I thought I had a good chance of passing the test the first time. I felt that I better understood math after college. After coming out of the test, my first impression was that I was a failure and that I would never have a teaching job. But, I was a college graduate with an approximate 3.0 average. (Questionnaire)

She tried the test in both formats, the paper/pencil and the computer based which displayed the score on the screen immediately after the test is finished. Although her test strategies for solving the problems were similar for both formats, the computer score display resulted in immediate disappointment.

> Probably on both tests, it was trying to remember and refresh in the car on the way there any formulas that I might forget, any little quick ways to work a problem and not get

> bogged down by the extra information. On both of them, computer and paper/pencil, during the test I would read the question and think how do I work this? How have we reviewed to understand how to do this? But after would be different. On the computer, by knowing your score, which I never passed on the computer, so knowing then that you failed just kind of ruined you for the rest of the day. After you had put all of that hard time into studying and you review and everything on and on, then you don't pass. Coming out from the paper/pencil … you just wait with that one. So I think maybe waiting is better because you don't feel so bad. (Int. 2, L. 591-601)

Peyton worked for 14 months using practice books, computer software, and tutoring sessions. She took the PPST-Mathematics test 6 more times during those months at either $55 for the paper/pencil test or $80 for the computer based test. She finally passed the test on the 7th attempt in March, 2003. I asked her how that success had changed her view of herself as a math person.

> I'll toot my horn and say I felt kind of smarter in math. Since you've struggled so many years with so many different teachers and different skills with learning the math and when you finally study so hard, with the help of others, and you finally pass and you think, "Oh thank goodness. I was finally able just to do it". Reach the top of that hill and keep going. (Int. 2, L. 544-547)

Peyton credits one practice book for being the most effective in preparing for the test, *1001 Math Problems* (Tarbell, 1999):

> The one big, major book was *1001 Math Problems*. Second thing that comes to mind is on a local …public television show, in the afternoons, they have a homework hotline. They always do math problems, so I would watch it. We also worked through other math books. The pink and the green. (Int. 2, L. 566-569)

Using an answer sheet that I designed, Peyton worked through the entire book, checking her answers with the back of the book and marking any answers that she did not understand in order to ask me. Because the *PPST-Mathematics* prohibits the use of the calculator, she worked the entire set of 1001 word problems without using a calculator in order to review the arithmetic skills needed for the test. This strategy appeared to be the most effective for her.

Considering what she would tell others who may be taking the PPST-Mathematics test, Peyton offered this advice:

> There's several things. Save your money [to pay for the tests]. The second would be to decide whether you're better taking it on the computer or paper/pencil. And that may be very hard to see but decide looking at your past years in school, did you do things better on the computer or on paper? Third thing, find people around you who are very supportive in you obtaining this goal. (Int.3, L. 492-495)

She also thought that starting with the *1001 Math Problems* (Tarbell, 1999) book to prepare for the test would be the best strategy if she had to start over again.

*Appalachia*

Peyton, on the initial questionnaire, simply stated, "I grew up in a very rural community." She was an only child who lived with her parents and near her mother's parents on farmland in Central Appalachia outside of the small town where the middle and high schools are located. She described the area:

> Well, are you familiar with the small town? There are really no streets, you just have the paved road, and we were lucky enough to have stripes on the road so we're not that back woods. The closest neighbor you could walk to. I remember walking through the fence and I would walk up the hill and I would be at one neighbor's. The other neighbor was my uncle and I would walk down, walk through what used to be the old dairy barn and so forth and be at his house. But it wouldn't probably take me maybe five or ten minutes depending on how slow I wanted to go. (Int.1, L. 107-124)

> With being from a small town and you know most people just worked on the farm and I knew I didn't want to do that, and I didn't have the skills for that, so there really wasn't anyone [in another job that I was interested in]. (Int. 1, L. 77-79).

Peyton reflected on her realization that the area where she lived might be different from other places:

> They were [obvious differences] and also in the few [television]channels that we had, because my parents would always ask what was on such and such channel at such and such time, and I would always know that, but as I began to watch television more you would see how people would talk differently than you did and dress differently, so yes there was somewhat of a difference. (Int. 1, L. 120-124)

> I think that question [about Appalachia] you could just go on and on and on about even if you may think of something now and then other memories come later. I probably didn't realize that I was from a small area until middle school and I say that because when the 5th grades visit, they're actually a feeder school into the next school, I didn't realize that until you saw the band play and all the different things you can do as a 6th grader. So what they did on that particular day as they called you by school to load the buses and so there were thirteen of us in 5th grade at the elementary school. We were the smallest row to stand up and so all of the other seats were full. That's one memory. (Int.4, L. 246-254)

> Another [memory] is watching TV, even though we didn't have cable TV I knew what channels we could get which was 5, 6, 11, and 19. I knew what was on and when it was on. You kind of start getting older and you get piece things together about this area. Then you start looking at middle school where you have people from everywhere and it's just little ol' you from this small area. (Int. 4, L. 255-259)

> You adapt. So middle school and high school you learn more people that live in the same county as you do. As far as what Appalachia means, it's home, it's where you grew up, it's what you remember, it's the country experience. Then you look at when you travel places how people hear you talk. Still looking back on Appalachia you also appreciate the

> area more after you have more world experience as far as travels and different things you might do later as you grow up. (Int. 4, L. 268-274)

Peyton values the lessons she learned from the rural life:

> I would always, which I still do now, I always liked to sleep late so that was one big thing. My mother would always leave lists, please clean this room, please dust this or do such and such. I would always, since the third grade and until I left home, mowed the family's yard and everybody would wave at me as they drove up and down the road so that was an activity. I have another uncle who lives in Atlanta, and he would always drive in with a truckload of watermelons, peaches, cantaloupes, any kind of fresh fruit. So any of those that needed to be canned, and also my family had a garden, so all of that, planting the seeds and watering, I did all of that. I planted flowers in front of the house. (Int. 1, L. 131-139)

> I think now compared to other people my age, I think too I have some more knowledge maybe not all that other people have in areas like that…That's one of those, any of those or all of those areas, you can't go back and relearn that. So you're looking back now and you're glad you had the chance to learn that. (Int. 1, L. 145-146, 150-151)

Though not specifically an Appalachian studies project, Peyton's interest in local history was encouraged by her social studies teacher at the high school:

> In [our high school social studies]class we had to pick either a city or a topic, I'm not sure just how the question was worded, so I chose to write about the small community that I lived in. Included pictures and I think I made an A on that, I'm almost sure I did. But I remember when I picked that up or turned it in, he said, "I've never received anything written on this area before",[meaning] the small town where I was from. (Int. 3, L. 569-573)

> Another thought to current involvements, there is a local historical society that one of my former teachers is involved with. So I emailed him and asked him what I needed to do to become involved. I go to some of the meetings but I'm not fully involved but I do fill a seat. The most recent thing they had was not this past weekend but the weekend before, they had a Malaysian speaker come in. I thought thirty minutes or an hour, it ended up being over two hours he talked. I took notes and I thought how wonderful he was. He actually, which I found interesting, he knows his origin and he is Malaysian to whatever percentage. He was actually born with six fingers and he also has dyslexia. So he had no written notes, he just got up there and talked. He's wondering if the dyslexia and the six fingers maybe came from cross breeding between people way back when. (Int. 3, L. 502-511).

*Family*

So much of what is rural and Appalachian is tied to the family. Peyton wrote about her mother and father in the initial questionnaire:

> While I was growing up, my mother was a full-time housewife, and she cleaned houses part-time. She attended public schools and completed through the 12th grade. My mother loves to cook, clean, sew, can garden vegetables, work in the yard, and plant flowers. Her favorite activity is decorating her home. Her special talent is "pulling together" colors that coordinate in her home.
>
> At the beginning of his working career, my father was a mechanic, a coal miner, a general laborer, and a farm hand. Currently, he is disabled. He dropped out of school in or around the 10th grade. In previous years, he loved to paint the interior/exterior of the house. He has a talent for understanding and/or repairing mechanical items. In the past, he loved to tinker with mechanical devices. Now, he works in the garden and the yard and keeps the family vehicles clean.

Peyton's parents were very interested in her education, helping her with homework, seeking out tutors when needed, and teaching her important living skills. She recalled:

> My parents tried to help as much as they could but with their limited education, I guess that would be the right word, they could only help me so far. So then friends of the family began to help and the tutors. (Int. 2, 384-385)
>
> Pertaining to schoolwork, they helped and did what they could do. But still there was such, I guess the right word is a lack of education where I went so far and they just couldn't help me. The other side of that, at home, that was just I guess as you would say, "the way of life", where you would help cook the supper, you would help can, or you would help mow the yard. You would know how much to turn the wheel this way to mow or how far apart to plant the roses, things like that. (Int. 2, L. 510-515)

Although her parents saw to it that she attended preschool and had tutors when needed, Peyton was not involved in any out-of-school activities. "My mother said that ballet was popular at the time, but I was not enrolled because my father was laid off from the mines" (Questionnaire).

Her mother and father believed that she should attend college, but lacked the experience to provide specific guidance.

> Coming from a background of family who basically did hands on work, college was introduced by cousins and other relatives. I also have an uncle who went to college, so the family knew that to achieve and to be successful you would need that college education. So that's why I went, with really no further insight into what I wanted to do. I just knew that I had to go. (Int. 1, L. 42-46)

I asked Peyton if her college degree made her parents view her any differently. She responded:

> Probably the answer is some of both, as strange as that sounds. Probably in the student mode as hard working but still on the other hand of that it's just like, "Well you're just another so and so in the family." There's really not a lot of difference placed on the degree or anything like that. (Int. 2, L. 484-487)

Peyton's childhood home was very close to that of her maternal grandparents. She stated, "My grandparents influenced me. My grandfather, according to my mother, wanted me to be something. They had to work very hard for what they had" (Questionnaire). She remembered:

> Since my grandparents lived so close there would be times that one day I may catch the bus at my house and the next day catch the bus at their house. This particular memory, my grandparents, my grandfather worked in the coal mines and on the side he worked on the farm, so he kind of piddled in later years. But in kindergarten, that one day, I was at their house getting on the bus and I was waiting and waiting, and he said that he thought I had missed the bus so here we go in the big cattle truck. He's taking me to school and I don't know if my mother passed us or somehow she remembered, I remember her saying I was just sitting up so straight in the seat and afraid to move but he was kind enough to take me. But the funny part is we get to school and we were actually early so the bus came maybe five minutes later. (Int. 3, L. 548-558)

Peyton spent a lot of time with her grandmother as a child and wrote fondly of her in the initial questionnaire:

> My grandmother was a very influential family member. She completed the 10th grade. My mother remembers that my grandmother stayed away from home to obtain this education. Grandmother did not like staying with Spencer Kennedy's dad during this time. She school was located in [another state]. She was 64 years older than me. She passed away in 1998, at the age of 85. I was 21 years old at the time.
>
> She was a very smart person. She managed money well. She was level-headed. She would sing at church, but not in the choir. She was nice to people, but she did not socialize a lot. She loved to stay at home. She enjoyed gardening, sewing (needle work, embroidering, quilting), planting flowers, and canning. She also loved helping me with my studies. She also wanted to be a teacher.
>
> I always loved to go to Grandmother's house. I could walk through the pasture and be there in no time. When my parents were working, she was my babysitter. On numerous occasions she would read to me. I remember on a math worksheet, I had missed a problem, and she explained to me why. My answer was 7; however, it looked like a 1. She told me to put an extra line on the 7.
>
> When I was younger, my mother drove all of us to the local bank. Grandmother and I would sit in the car and count change. One summer, we made a quilt together. I mowed her grass several summers. Another summer, I painted the fence. When I started driving, she would sit in the passenger seat with her legs crossed.

It was her grandmother, also, who encouraged her interest in local history and respect of the past. Peyton recalled:

> During one of our talks before we talked about visiting the cemetery, my grandmother was always big on that. Even if the relatives [were ones] I don't remember, we would still

> go. And even still now it's like the cemetery is if you're looking for a memory or looking for some positive from those people. You just go there and just visit and stand around and hope no one is looking at you funny and pay your respects so to speak and be on your way. That's another big item. (Int. 3, 560-564)

Peyton also attended the church that her grandparents attended.

> I'll start as a child and then come to present. Growing up church was not an item of great importance. Around middle school, I'm going to say, we started going to Buckeye Church. We would attend the evening service and the reason for going to that church is my mother and my grandparents growing up attended. No we attended Walnut Creek and they attended Buckeye because they lived in Buckeye for a number of years until 70 something when they moved. So there I was involved in vacation Bible school, I was in two Christmas plays, I was in one the first Christmas and then as they were getting ready for the next Christmas the lady asked if anyone wanted to do anything outstanding or so forth and I said I would like to be an old lady. So we had old glasses and a shawl and old shoes that I think were my great grandmother's that I wore. I had shorter hair and I put baby powder in my hair. So I was an old lady in the play. Then into high school we still went some to that same church. (Int. 3, L. 698-708)

Other family members were involved in Peyton's life as well. She remembered, "Fourth grade, we had to do a project and I built, well actually I helped, I didn't build it, my great uncle and I, we built a bird feeder and the class watched the birds come" (Int. 3, L. 557-558). Additional family connections were:

> Cousins, they would come in usually once or twice a year. So with the cousins we would always, I remember one particular story of a cousin who is now an accountant, we would get into pillow fights, and he'd turn me upside down. (Int. 1, 160-162)

Both Peyton and her husband remain very close to their respective families and get together with them often for holidays and birthdays.

*Final Thoughts*

Peyton has had classroom experience teaching a variety of grades and subjects as a substitute teacher. She was a long-term substitute for nine weeks in a second grade classroom, and she put thoughtful effort into planning the classes, especially in mathematics. Peyton forwarded me an email from one of the parents of a student in her classroom during that time. It read:

> I really wish you would have finished the year. Nothing against [the regular teacher], but the children miss you and speak of you often. I think it is hard on them to switch teachers in the middle of the year. You should have a full-time teaching job soon if the school system has any sense whatsoever. You are a wonderful teacher.

In addition, Peyton's biography will be published in *Who's Who Among American Teacher*, although she does not know who nominated her. She considered the ups and downs of her own educational experience, both as a student and as a teacher:

> With teaching others you realize that with this new confidence that you can do this and you're not shy and that even people from a small area. They may not be students that excel, but they can still help others. (Int. 4, 75-78)

After I had written Peyton's life story, I asked her to reflect what how telling her story may impact her teaching. She replied in an email on July 6, 2005.

> First, what went wrong with me? Was it the teachers I had, the materials used, the schools I attended, parents, or a learning problem/difficulty? Also did those educators past and present struggle with math? Or were they just bad teachers?
>
> Second, I don't want the students I have falling behind like I did and have to spend more time studying to relearn material for these [SOL] tests. It seems I have done a lot of relearning. One needs to watch and see if the students are paying attention during the class discussion, for example, with comments [such as] "I understand" or "I get this." The teacher needs to make math come alive for the students, using manipulatives. The teacher should make their worst subject the students' best subject.

Peyton has been hired as a long term substitute at an elementary school just outside of town in the fall. She is continuing to work on her teaching license through a graduate program at a university.

*Synopsis of Mathematics Learning in Appalachian Public Schools*

Because Peyton was the participant in my pilot study, I have had a longer period of contact with her, and through her willingness, more data artifacts. Her life story was constructed through four interviews and multiple additional conversations. She took a remarkable interest in discovering her own story, searching for past school records, yearbooks, newspaper clippings, all of which she entrusted to me. She even talked to some of her former teachers, under her own initiative, asking them questions about their impressions of her as a student. She keeps in contact with me through telephone calls and emails when she has additional memories or insights into her mathematics difficulties, and she shares with me her successes with students in the classroom. As a result, she is constantly refining and re-interpreting her own life story, so the one presented in this document is complete only up to the date that she proofread and made notes on it. Her view of learning mathematics is becoming more complex, yet the data support that many aspects of the Appalachian culture have impacted that learning: rural isolation, family ties, and school and teacher quality issues.

Peyton lived on a farm near her grandparents; she enrolled in nursery school where she remembered doing mathematics, such as counting and playing with blocks. This experience, along with the time she spent with her grandmother who used opportunities to teach her, helped her to begin her school career ready to learn and with positive anticipation. She attended a tiny country school for grades K-2 and loved kindergarten and first grade, but could not remember any mathematics lessons. Peyton liked her second grade teacher but wondered how good a teacher she really was because Peyton recalled having to catch up on skills in the third grade.

Her usually quiet mother even questioned if the second grade teacher might not be qualified to teach. Peyton's primary grade school was a characteristically small rural school, which would not be a problem in itself, but poor teacher qualifications and their lack of preparedness in areas of rural poverty may result in students at risk for lower mathematics achievement (Khattri, Riley, & Bane, 1997).

Peyton's graph of mathematics ability (Figure 3) showed a decline beginning in Grade 3 when she attended a different, but still small, rural school. Peyton sensed that she struggled a bit in mathematics, especially when learning the multiplication facts which she did at home with her father's help. Similarly, in a survey given by Jackson and Leffingwell (1999), several preservice teachers recalled difficulty in learning mathematics facts and with taking timed tests in third and fourth grade.

"You know, I did study, but fourth grade kind of hit hard with math" (Int. 1, L. 204-205). Peyton recalled struggling specifically with homework, division, and word problems. "I absolutely hated [word problems]…I could not remember from what the problem said to write it down on the paper. It would go through and not even stick" (Int. 3, L. 195-197). Peyton did not remember having been shown problem solving techniques, other than finding clue words within word problems, so she relied on her memory again. Recognizing this as a common strategy, Schoenfeld (2003) stressed that problem solving should be "seeking solutions, not memorizing procedures" (p. 334). Silver and Castro (2002) observed, "In high-poverty classrooms instruction is frequently based on the 'conventional wisdom' that students are deficient and that instruction should emphasize practice on basics before moving to more challenging material involving problem solving or reasoning" (p. 11). Though Peyton was assigned homework that involved problem solving, it was likely to practice some basic skill or procedure covered in class that day (Schoenfeld). Peyton had "a very tough teacher" (Questionaire) for fifth grade, but had few memories, made average grades, and achieved above her grade level on a standardized test in mathematics.

Peyton entered the consolidated middle school for sixth grade, making the difficult transition from a small country school. She considered her sixth grade mathematics teacher "horrible" (Questionnaire) and wondered if that year may have added a "new layer of bricks" to her wall of misunderstanding in mathematics. The sixth grade teacher relied on showing a problem on the board, then assigning seat work, just "not really making learning fun" (Int. 1, L. 512). She also noted that the teacher "didn't have a relationship with anyone (Int.3, L. 109). In seventh grade, Peyton had a younger teacher who "made learning fun" (Int.1, L. 546), but Peyton felt that her background was weak, and she did not do as well as she hoped. Her confidence in her mathematics ability grew, however, in eighth grade when Peyton had another good mathematics teacher who also "made learning fun" (Int. 4, L. 460). He made the class interesting and explained the mathematics well, so that for Peyton, "the light bulb was fully on" (Int. 4, L. 103). Guilaume and Kirtman (2005) studied the mathematics biographies of 144 preservice teachers in a mathematics methods class and found in most a similar pattern of uneven mathematics instruction throughout the grades and the teachers were a most powerful influence in either a negative or positive way.

As a high school freshman, Peyton took Algebra I, and despite the fact that she had good grades on her report card, she felt the class was boring and remembered little about the class except that the teacher had trouble with discipline. The next two years of high school mathematics represented the lowest points on her graph of mathematics ability and confidence

(Figure 3). Perhaps a weak Algebra I background contributed to her struggles in mathematics courses for the next two years.

In tenth grade, she took geometry which she considered “a very tough class” (Questionnaire). Peyton ascribes her difficulty with geometry to the teacher’s explanations and that her strategy of memorizing did not work. She also recalled having a lot of free time in class. Peyton’s experience in eleventh grade with Algebra II was even worse. This teacher, in Peyton’s view, “lacked the ability to teach” (Questionnaire). Her primary teaching strategy was using the overhead projector to put up problems with little explanation. Peyton worked with a tutor after receiving a D for the first grading period. In both tenth and eleventh grade, Peyton struggled mightily with mathematics, though she was successful in her other high school courses and enjoyed clubs and being a work-study student for the business teacher.

Peyton believed that her uneven mathematics instruction in public school resulted in problems for her on the *Praxis I* Mathematics test and wondered what she could have done. “First, what went wrong with me? Was it the teachers I had, the materials used, the schools I attended, parents, or a learning problem/difficulty?” (Personal communication, July 6, 2005). Perhaps these questions motivate her in her continued search within her educational background.

# Chapter Seven

## Cross-Case Observations

*Research Questions*

- What are the life stories of pre-service and in-service elementary teachers from Central Appalachia, and how do they view their experiences in learning mathematics?
- How did aspects of the Appalachian culture influence the participants' view of their own learning and their images of themselves as capable in mathematics?

*Life Story Parallels*

Collaborating with three young women to create their life stories was both a privilege and a pleasure. I marveled, not only at their memories and descriptions of events and feelings, but of their courage and determination in reaching their educational and life goals. All three were in their twenties, relatively young to have a complex life story, it would seem. But their recollections and interpretations of the experiences of their growing-up years have much to offer us as teachers and scholars. The three women lived within thirty miles of one another in Central Appalachia and attended different high schools, yet many of their experiences were remarkably similar. All three life stories revealed obstacles to learning mathematics, many of which arose from the rural poverty and the Appalachian culture of the region where they were schooled. Their ability to overcome the obstacles was also related to aspects of the Appalachian culture.

The three women came from supportive and loving two-parent homes. Laura had an older brother and lived in a small town. Though her parents had been poor growing up, they lived a relatively middle class lifestyle. However, when her father had a stroke, money was scarce, and Laura had to work to go to college. Faith lived in a smaller town and had two older brothers. Her father became ill and died while she was in high school, so the family struggled financially in order for Faith to go to college. Still they lived a relatively middle class lifestyle. Peyton was an only child and lived out of town on a farm. Her father became disabled when she was in elementary school, so they did not have money for extras. Their lifestyle was relatively lower middle class. Laura and Peyton attended older medium size high schools in fairly good condition that are still in operation. Faith attended an older high school in poor condition that has since been closed. In spite of family setbacks and less than optimal school experiences, these women succeeded in graduating from college.

The initial connection that I made among Laura, Faith, and Peyton was their difficulty in achieving the minimum score on the *Praxis I* Mathematics test. I worked with each of them individually to study primarily middle school mathematics content, and each subsequently passed the test. My time with them convinced me of their intelligence and tenacity toward reaching their goals. After their interviews and assembling their life stories, I found many other striking similarities, some related to the Appalachian culture.

Each of the women remembered their early grades experiences as mostly pleasant, yet they all considered the middle grades to be a low point in their learning of mathematics. Shyness was a trait that each felt they had, at least in the early grades, and it impacted their desire to participate in class activities. In addition to being successful students in terms of grades and teacher assessments, each woman demonstrated extraordinary effort as shown by seeking help for mathematics from tutors and family members. In high school, each of them struggled with geometry class and believed that their difficulty in the subject was because of a lack of their own abilities. Each woman had considered taking higher mathematics as a senior in high school but

decided not to, although the option was available at each of their schools. Despite leaving high school with little confidence in their mathematical abilities, all three considered themselves to be successful in college mathematics courses. Unfortunately, each woman had more than one ineffective teacher in kindergarten through twelfth grade for mathematics which had varying degrees of influence on their mathematics learning in later grades. All three women had a similar definition of the Appalachian stereotype and were determined to overcome that negative image. School facilities, teacher effectiveness, and gender biases appeared to be influenced by aspects of rural poverty and were amplified by being situated in the Appalachian culture.

*Positive Early Grade Experiences*

All three women enjoyed mathematics in the early grades. Laura's self-assessment chart (Figure 1) showed Kindergarten through Grade 4 as very high to midrange; Faith's self-assessment chart (Figure 2) showed Kindergarten through Grade 3 as "Loves Math" and Grade 4 as "Math is Okay"; Peyton's Chart (Figure 3) showed Nursery School through Grade 3 as mid-range or better. All three remembered their first grade teacher fondly in all subjects, including mathematics:

> I had my own thoughts, my own ideas, my own weaknesses, my own strengths and when I couldn't do something, just by [the first grade teacher] giving me small sequential steps and allowing me to master the smaller things made me want to accomplish even the most challenging things. I always felt rewarded in her class. (Laura, Int.2, L.23-32)

> I remember my first grade teacher, that was Ms. Perry, and I always wanted to be like her. She was just an excellent teacher and what I remember most about her was how caring she was. That's the one thing I remember most. (Faith, Int. 1, L. 111-113)

> There were some, like the first grade teacher, that just by looking at the names [of all my teachers] here on the questionnaire; she stood out above all of those. Could be because she was younger at the time, I think too it's just her personality…I still think by being younger and by introducing different concepts and making learning fun helped the first grade teacher. (Peyton, Int. 1, L. 452-457)

The women remembered a few pleasant things about the early grades including, mathematics worksheets, counters, and special projects. All three remembered learning multiplication facts in the third grade. Laura and Faith enjoyed it. While Peyton learned them, it was more of a struggle, so her father read them aloud on a cassette tape as a study aid. Quite the opposite, Laura won the "Hot Seat Award" for multiplication facts; it was one of the artifacts she showed to me.

The enjoyment of the primary grades is not surprising because all of their parents had prepared them for school in a variety of ways. Laura's mother taught her at home to read and count. Both Faith and Peyton went to a church pre-school prior to kindergarten; in fact, Faith's mother was the teacher. Not only did they all learn academic skills prior to formal schooling, they learned school behaviors which eased their adjustment to kindergarten. The strong family and community ties, indicative of Appalachian culture (The Rural and Appalachian Youth and Families Consortium, 1996) as well as other cultures, may have also played a part in the successful primary grade experience for the three women. Faith and Peyton both attended a very

small rural community school knowing many of their classmates outside of school and their parents knew the teachers well. Laura, being one of very few African Americans in the town school she attended, suffered a setback when her kindergarten teacher initially made harsh statements to her regarding her shyness and stuttering. However, she recovered and loved school in first grade. All three had female teachers who formed a bond with them, and the relationships with those primary teachers were described as warm and friendly. Because they connected with their primary grade teachers, they viewed learning all subjects, including mathematics, as pleasurable and attainable. The importance of the affective domain to learning also proved to be evident in a qualitative study of the attributes of effective teaching by Wall, Nardi, von Minden, and Hoffman (2002). The most prominent theme, as described by the 90 pre-service and experienced teachers, was emotional development. "Caring about students was particularly prevalent in the descriptions of effective teachers" (p. 45).

*Low Point in the Middle Grades*

Laura and Faith placed the lowest points on their mathematics self-assessment charts in grade 5 (Figures 1 and 2) with Peyton denoting grade 6 as her lowest point up until she went to high school (Figure 3). Laura's experience in 5$^{th}$ grade was with a teacher who repeatedly told her class that females could not do mathematics. As a result, Laura missed out on classroom activities and opportunities; for example, she was denied a chance to take the placement test for middle school and was subsequently placed in a middle track for grades six through eight. Laura recalled, "It affected me completely and I shut down. I begin to hate school. I did not believe in myself anymore." (Laura, Int. 1, L. 117-118)

Faith's fifth grade year was also a turning point for mathematics. "Up until 3rd or 4th grade I felt like I was a great student with math, but when it got to 5th grade I was thinking something went wrong, and I didn't like math as much" (Faith, Int.1, L. 23 -25). The year was not a good one in terms of her other classes; in fact, the discipline was so poor in her first period class that she was afraid to go to school. Faith remembered the mathematics as being more "drill and practice, textbook, and I'm a person that has to see it and feel it before I can comprehend it" (Faith, Int. 4, L. 20-21). She was one of the top students in terms of grades, but the competitions at the chalkboard in fifth grade mathematics were based on whoever could get the problem correctly done in the fastest time. "Everyone expected me to have the answer, and when I didn't it was very embarrassing for me. So I would dread going to class, I hated it. In middle school, everyday I dreaded math**"** (Faith, Int. 1, L. 46-48). Faith had lost her confidence in mathematics, and she hated it, according to her graph (Figure 2), throughout the rest of her public school years.

For Peyton, sixth grade brought a switch from a self-contained classroom in a small country school to a larger consolidated middle school. She did not like middle school in general, but for sixth grade mathematics she had a "horrible teacher" (Peyton, Questionnaire). Peyton considered her to be uncaring and unapproachable. She was already feeling a little behind in her mathematics from fourth and fifth grade, and she felt that the teacher's explanations were not effective. The teacher did not give extra help, so Peyton tried to get help at home with the homework. As a result, "math was still just a struggle" (Peyton, Questionnaire) in seventh grade.

Gender bias played an obvious role in Laura's declining interest and confidence in mathematics as her teacher openly espoused a damaging belief, that men were better at and more suited for mathematics than women. However, in a way less obvious to them, Faith's and Peyton's increasing feelings of alienation in the middle school mathematics classroom could have resulted from teaching practices which were more suited to males while subtly undermining

the women's mathematical self-image (Koch, 2003). Faith experienced anxiety in classroom competitions that were based on speed at the chalkboard, in addition to having teachers she considered flirtatious or who enjoyed presenting mathematics as a difficult subject, beyond the reach of most students. Peyton remembered a class where one of the boys was allowed to repeatedly get away with misbehaviors. In addition, she described her sixth grade teacher as unwilling to offer support, which when coupled with her shyness, caused her to "just hope that somebody could help me" (Peyton, Int. 1, L. 540). Lim (2004) studied the mathematical experiences of middle school girls and found inconsistencies with the girls' learning style and the classroom culture:

> It is not surprising that these young adolescent girls' motivation for learning school mathematics is significantly damaged when they intuitively grasp the inexorable tension between their desire to be respected as active learners and the repressive characteristics of instructional culture in their mathematics classrooms. (p. 52)

She also described the girls in her study as having a "fragile identity in mathematics" (p. 53) and observed that they were highly susceptible to the negative comments from their fellow male classmates and those in authority.

In reviewing research on gender in mathematics, Leder (1992) discussed a range of variables contributing in varying degrees to the gender gap: biological, school, teacher, parent, society, and internal. Teacher expectations, interactions with students, and choice of classroom activities combined with female internal beliefs, such as taking personal responsibility for failure may have subtle separate effects on mathematics achievement, but these effects appear to be cumulative (Leder). Wick and Kenschaft (1997) refer to these variables as "microinequities" (p. 209). In the experiences of the three women in my study, clearly biased statements, an emphasis on competition and speed in mathematics, and the low quality and quantity of teacher interactions could have comprised a series of microinequities which impacted their mathematics learning and confidence. The gender bias problem may even have been intensified by an aspect of the Appalachian culture, a climate of male dominance, according to DeYoung (2002) who observed in one school district that sports and holidays were aligned as recreational activities for the boys.

Factors, in addition to gender bias, may have played a role in the decline of confidence and achievement in mathematics when the participants entered the middle grades. The mathematics content would have presumably been a bit more advanced and include more topics which required a higher level of learning than they had faced in elementary school. For Faith and Peyton, their mathematical low points came in years where they made the switch from a self-contained classroom to a "mathematics" teacher. In all three cases, the teachers' actions and comments were detrimental, or their instruction and assessment strategies were ineffective.

Swetman (1994) studied mathematics attitudes of 663 students in grades three through six from small rural schools in relation to their teacher's attitudes and found the fourth grade to be of particular interest. "Even though the fourth-grade teachers exhibited the lowest level of mathematics anxiety and the most positive attitude toward mathematics among the teachers investigated, the fourth grade students exhibited a strong negative attitude toward mathematics" (p. 173) In a 1989 study of middle grade levels, Midgely, Feldlaufer, and Eccles acknowledged children's declining mathematics abilities from fifth to tenth grade and investigated that

relationship to teacher efficacy[12]. They found that teacher efficacy positively correlated with student achievement, especially with low-achieving students. Turek (2005) used data from 1,450 Virginia schools to study teacher quality and student achievement variables. He found:

> Incrementally, as the poverty level of a school's population rises, few highly qualified teachers are in the classrooms. The second hypothesis predicted that students in large cities and rural areas would have unequal access to qualified teachers. Results supported this hypothesis as well. (p. 423)

In the case of the three participants, their teachers, above all other factors, seemed to make the most impact on their attitudes and achievement in mathematics.

For Appalachian students, however, switching from one teacher and one classroom to a 7-class-period day with seven different teachers may be a bit more unsettling due to having to navigate new territory with new teachers and students promoting a sense of alienation with school as noted by U. M. L. Reck and G. G. Reck (1980). Another connection relates to lower class culture where students are more likely to succeed when they form a relationship with the teacher, who is encouraging and a role model, especially if the teacher can remain with that student for more than one year (Payne, 2001). Laura's confidence in mathematics, for example, grew when she had Mrs. Driver for two years; she credits her for encouraging her and teaching her the math background skills. Neither Faith nor Peyton had an encouraging teacher for mathematics in middle school.

None of the women remembered specific mathematical instructional strategies, nor did they recall being shown metacognitive strategies for mathematical problem solving. But all three seemed to illustrate Theule-Lubienski's (1997) conclusion that lower class students "think a good teacher is one who shows she cares by explaining clearly and helping them understand" (p. 244). Peyton emphasized the importance of explanations: "She [the math teacher] didn't explain it clearly, I don't think. Because I know that particular year I did have a tutor and I could say, 'Explain this,' and the tutor would explain it and then I would just get it"(Peyton, Int. 1, L. 706-707). The only mathematics strategy that the women mentioned was memorization to learn multiplication facts in third grade. Relating mathematics to memorizing would undoubtedly be less and less effective as the women progressed through their mathematics courses as higher level mathematics classes would require "seeking solutions…exploring patterns…formulating conjectures"(Schoenfeld, 1992, p. 335). Peyton had tried memorizing in her high school mathematics class, but that didn't work. "It was just very hard. I never, I'll tie in all this memorizing, I would try to learn and memorize but it still wasn't there" (Peyton, Int..3, L. 233-234). Faith talked about memorizing to prepare for tests. "I think that I'm the type of person, I crammed for a test and then after I take it, I forget everything that was on it. I think that's what happened, it didn't stick with me" (Faith, Int. 4, L. 92-95).

Another noticeable feature of the middle school mathematics classes, which could have related to gender or culture, was a lack of class discussion or opportunities for questions, especially by Peyton and Faith. "I would slide down in my seat so I wouldn't get called on. I just hated it so much" (Faith, Int. 4, L. 75-77). In 6th grade, Peyton tried to go unnoticed in the classroom, "I was sitting in the back, which I think was another wrong mistake…She [the

[12] Teacher efficacy is the set of "teacher beliefs about their personal effectiveness" (Midgely, Fedllaufer & Eccles, 1989, p. 247). "The question of how these teacher beliefs are communicated is an important one. Teachers' sense of efficacy may influence both their motivation and instructional strategies" (p. 255).

teacher] would show a problem or two on the board then you would have some classwork and some homework after that" (Peyton, Int. 1, L. 509-513). Laura wanted to participate in 5th grade mathematics class, but "if I raised my hand in class, and I knew the answer, she would purposely overlook me, and she would call on the boys" (Laura, Int. 1, L. 60-61). With "the importance of dialogue between learners, teachers, and texts" (John-Steiner & Mahn, 2003, p. 147) for cognitive development in a socio-cultural context, the reluctance of the women to speak or the lack of opportunities to ask questions could have been an obstacle to their learning of the mathematics content during the middle school years.

*Shyness*

Another factor contributing to the reluctance of the three women to speak in class was shyness. All three women described themselves as shy which could have played a role in their unwillingness to ask their teachers questions about things that they did not understand. Laura called herself "a shy student" (Laura, Int.1, L.20) in kindergarten, and referred to "my shyness" (Laura, Int.2, L. 221) in first grade. It continued in second grade and was the reason she did not participate in gifted classes that year:

> After the tests were administered, the results were given that I was gifted, but my teacher felt that because I was so shy that I wouldn't benefit from gifted, so I was denied to participate in the program that year. (Laura, Int.2, L. 252-261)

In earlier grades, Faith considered herself as someone who was embarrassed when she worked a mathematics problem at the board and made a mistake. "I would get so nervous that the teacher would call on me, and of course I looked like an idiot in front of the class" (Faith, Int. 1, L. 44-45). Then in seventh grade, she had made progress, "I was always kind of shy, so at first [junior high school] was really intimidating but I made friends, and I had a lot of fun" (Faith, Int. 2, L. 218-219). Peyton also suffered from shyness, although she feels that she has overcome it: "I was a very shy person. I really didn't speak out like I do now" (Peyton, Int.3, L. 621). She wondered, however: "If I would have maybe spoken more, it would have helped. You blame yourself some, maybe not 100%, but at least maybe 25% or 50% of it" (Peyton, Int. 3, L. 634-635).

In addition to the above connections made about the limited or non-existent discourse in the mathematics class, according to the National Research Council [NRC], student-teacher interaction may do more than provide a pleasant classroom climate.

> Because the quality of the interaction of teacher and student around the content is so critical to the success of instruction, the most successful teachers are not merely sensitive to the cultural diversity of their students but use that diversity to enrich the learning experiences they provide to the class as a whole. (NRC, 2001, p.344)

Limits in interacting with the teacher due to shyness or a reluctance to approach her or him could have contributed to the participants' self-assessed declining mathematics abilities and confidence. Perhaps the shyness relates to a stereotypical Appalachian "backwardness" (Billings, 1974. p. 317) exacerbated for women due to the "maleness" of the society (DeYoung, 2002).

*Geometry*

All three participants had a geometry course in the tenth grade and all expressed a dislike of and a lack of confidence in the subject. On all three of their mathematics self-assessment charts (Figures 1, 2, and 3), the geometry year shared the lowest point with other significantly poor years for mathematics. Laura's teacher planted the idea that Laura just did not have the brains for geometry:

> Ms. Dixon, she taught me geometry. I didn't understand it, and she told me that I never would because I was too bright to figure out geometry. She said my brain worked where I thought things that were easy, I made them very complicated and complicated things I made easy. She was right because I never did get the theories and if opposite angles were congruent then blah, blah, blah. I never got that. (Laura, Int.1, 351-355).

Laura accepted Ms. Dixon's diagnosis of her geometry abilities: "For example, in algebra, I could do the formulas; I could do the pencil/paper, but on the other side when I took Geometry I really had to have an analytical side that I don't think I had" (Laura, Int. 2, L.584-585).

Faith also struggled with geometry and stated emphatically, "I hate geometry. I had the hardest time with geometry." (Faith, Int. 1, 338) Although she had a good teacher, Faith believed her difficulties with the subject to be almost beyond her control:

> In geometry I had the same teacher that I had for Algebra II, and she was a good teacher but it was like I just didn't comprehend it. I had always heard the saying that if you're good in algebra, you're horrible in geometry. So maybe I just went in with the stereotype that I am going to do horrible, but I just didn't understand it…I just always heard that. Everybody tells you. It might just be this myth around here that if you're good in geometry, you're bad in algebra and if you're good in algebra, you're bad in geometry. (Faith, Int. 4, L. 518-522, 526-528)

Peyton also believed geometry to be a natural ability. She remembered, "My mother would say 'Sit in the front so you can see the board and pay attention.' I would try to do that but still geometry was just, I didn't have a knack for it." (Peyton, Int. 1, L. 629-630) She struggled with the abstract ideas:

> That [geometry concepts] sticks out because of the class in high school where it was geometry with all the figures, and the formulas and what's congruent to this….That was the same year where we couldn't use the calculators so I guess I was mad the whole year about that. No, it was just very hard. I never, I'll tie in all this to memorizing, I would try to learn and memorize, but it still wasn't there. (Peyton, Int. 3, L. 226-227, 232-234)

The participants' aversion to geometry may be related to a passage from *A Research Companion to Principles and Standards for School Mathematics*:

> Most current curricular and teaching practices are simply, abominable. They promote little learning or conceptual change. They often do more harm than good. They leave students unprepared for further study of geometry and the many other mathematical topics that depend on geometric knowledge. (Clements, 2003, p. 171)

Despite the opinion in this source, all three women believed that their poor performance in high school geometry was the result of a lack of inherent ability revealing a sense of fatalism, a theme associated with Appalachia (Keefe, U. M. L. Reck, & G. G. Reck, 1983).

> Another explanation for the strong aversion to geometry may lie in gender differences. There is evidence suggesting that males and females or at least subgroups thereof, may differ in the processes they use to solve mathematics, particularly geometry problems. However, these differences have not yet been adequately investigated. (Clements & Battista, 1992, p. 456)

Differences in success on spatial visualization tasks have been noted between males and females which may contribute to facility with geometry (Leder, 1992). Even if males and females both solve a geometry problem correctly, they may not be using the same strategies, and whether this is influenced by biological or cultural factors is not known (Clements & Battista). All three women in my study struggled with geometry which could have been caused by or intensified by low teacher expectations, teaching styles incongruent with their learning preferences, and perhaps, gender differences.

*Extraordinary Effort to Learn Mathematics*

Despite their struggles with and escalating dislike of mathematics, all three women were model students in terms of behavior, grades, and attendance, exhibiting strength and resilience in the face of obstacles, a trait shared by many current and past Appalachians (A. Banks, 1992; Fisher, 1999; Maggard,1999). In addition to doing the work for their mathematics courses, all three women sought help and worked with tutors when they were available:

> [My parents] hired a tutor for me. [The son of a teacher] was my tutor at college…He was my tutor for a couple of sessions. They hired him to help me and they were really trying to get me the extra help that I needed. My brother would also help me at home. They didn't like to see me so down on myself. They didn't want me just giving up the ship. (Laura, Int.2, L. 887-894)

> Everyone, it seemed like, was having difficulty in this class. I did everything, looked for tutors and I stayed after school for after school tutoring. (Faith, Int. 2, 268-270)

> Well I tried really hard and I had tutors and you know I really worked for it but I still don't feel like I learned it. It was just that I excelled in all of the other classes but I think if I would've had a better outlook of it and more confidence then I could've done a lot better. (Faith, Int. 4, L. 117-120).

> Umm, she helped mostly up from Pre-K through fifth grade and middle school on up into college age that was mostly on my own or either with tutors. (Peyton, Int. 1, L. 36-36)

> What ended up happening there is the first six weeks I had a D [in mathematics class]. So my mother called [the teacher] or she called my mother somehow, which ever way it went, so then they decided I needed a tutor. Then the tutor was there so grades came up

> which was always better, but still there was really not the visual explanation from the teacher or what should have been going on never did happen. (Peyton, Int. 4, L. 51-55)

While the women clearly were willing to seek help from tutors, spend extra time, and do extra work to learn the mathematics, opportunities for support of their learning were unavailable, ineffective, or not enough of a duration and intensity to overcome the effects of poor or non-existent instruction in the classroom. Zucker (1991) stated, "Disadvantaged students' families, and their communities, are typically less able to provide concrete assistance to students for mathematics learning" (p. 199). The women in this study were not from impoverished families, but their schools are located in an area of poverty, and so the resources for additional support of mathematics learning were inconsistent or missing.

*Choice Not to Take a Mathematics Course in the Twelfth Grade*

None of the three women elected to take a mathematics course as a high school senior, but upon reflection during our interviews thought perhaps they should have. All of them thought that they just did not want to bother with mathematics again if they did not have to. None of three had specific guidance to take four years of high school mathematics, although Laura and Faith had teachers who tried to convince them to take a higher mathematics class. Laura, who said it would have taken "a miracle" (Laura, Int.2, L. 793) for her to sign up for twelfth grade calculus, based her decision not to take it on her experience with geometry:

> I guess because too I'm a perfectionist. I'm so hard on myself if I don't get everything in that class then I think I'm not going to learn and of course I made D's in Geometry. I made D's and that was like a shocker for me because I was always Ms. Honor Roll and I made D's and I felt really dumb because I honestly thought that D stood for dumb. (Int. 2, L. 811-815)

Even though a teacher whom she liked would be teaching the class, she still refused to consider it. "…Mr. Roberts was going to be teaching it, and I felt very comfortable with him. But still I didn't want to take the risk. I guess I was just afraid of not succeeding" (Laura, Int. 2, L.804-806). Laura did not receive advice to take more mathematics from her high school guidance counselor. She remembered, "My guidance counselor… told me that I should go to another college beside [a large state university] because 'people like me' didn't do those things." (Int. 1, L. 432-434). Laura, of course, assumed that the guidance counselor was referring to her race. Needless to say, that guidance counselor offered no encouragement to Laura in taking more challenging classes.

Faith thought that the major she had decided upon for college, which was psychology at that point, would not require extra mathematics courses. She was glad to have a year without mathematics, although the teacher that she thought so highly of gently encouraged her. She explained:

> I took Algebra II in high school and that was the last math class that I took. I got out of taking Trigonometry and other math classes because I was scared. I did not want to take it. I didn't want it to pull down my GPA because I was in competition to get the top spot in the class. So I avoided math all together. (Faith, Int. 1, L. 197-201)

The guidance counselor mentioned that Faith might want to take another mathematics class, but did not try to convince her.

Peyton's experiences in geometry and second year algebra in high school were so bad that she did not even consider taking another mathematics class. She did not feel that her guidance counselors were very involved in her choice of courses at all.

> I don't remember seeing the guidance counselor. They just kind of sat back in their office and you turned in what you were taking the next school year to them and that was about it. There was not too much more than that. (Peyton, Int. 4, 301-303)

Lack of guidance in terms of recommending course work, such as advanced mathematics courses for college, may relate to the teachers' and guidance counselors' views of the students in their own schools. U. M. Reck, G. G. Reck, and Keefe (1993) found the perceptions of both Appalachian and non-Appalachian teachers of native Appalachian students were negative when compared with non-Appalachian students in an Appalachian high school.

> High school teachers cited differences in the after-school club participation and selection for team sports, special attention given by teachers, counseling, tracking into upper or lower level classes and college prep versus vocational courses, recipients of honors and awards, and disciplinary actions. In all of these areas, town kids [non-Appalachians] were perceived as having the advantage. (p. 119)

In a survey of more than 2,400 eighth-graders and more than 1,900 twelfth-graders in rural schools, Bottoms and Carpenter (2003) found that "very few students receive any kind of guidance assistance" (p. 15) and "only 23 percent of students reported being encouraged to take more challenging mathematics courses" (p. 16). From her interviews with middle school girls, Lim (2004) observed, "Unfortunately, giving up and just 'sifting through' the minimum number of required classes seems to be the easiest option for girls who are losing their voices and confidence in their ability to learn school mathematics" (p. 56).

Although some Appalachia families may be fearful of their children going to college because it may cause them to find work and move away from home (DeYoung, 2002), family interest in and support of the women's desire to attend college was strong. "They [my parents] told me that if I wanted to get out of [town], I had to have an education" (Laura, Int. 1, L. 679-680) In Woodrum's (2004) study, middle class Appalachian parents were more accepting that a college education likely prepares students for employment outside the area, while poor Appalachian parents saw the fact that their children may move after graduation from high school as a sad reality. Teachers, who reflect middle class values, saw education as their students' ticket out of poverty.

> Many teachers then went on to express the belief that so long as poor students remained in the area, they were fated to lives of poverty. A major role of education, they maintained, and hence that of schools and teachers, was to help students develop skills that would enable them to secure employment outside the area, and thus create economically stable lives for themselves. (Woodrum, p. 5)

Likewise, teachers who believe the school is a cultural bridge to the mainstream culture, may support Appalachian students' desire to obtain a higher education (DeYoung). Yet without a solid background in preceding high school courses and a system of support for students who need it, success in higher mathematics courses would seem impossible.

*College Mathematics*

Despite a lack of confidence in mathematics and the reluctance to take additional high school mathematics classes, all three women considered themselves successful in college mathematics courses. All attributed it to a great teacher, and although they attended the same small college, none of them had the same professor for mathematics. At the time that Laura entered college, only College Algebra was required for elementary teacher licensure. After Laura tested out of Developmental Mathematics, she entered that algebra course and made A's. Like Laura, Faith tested in, then out of, Developmental Mathematics. Her success in mathematics at the college level helped to restore her confidence. Faith recalled:

> My next class in college was College Algebra II. I had an excellent professor, and I had an A in College Algebra II. I actually enjoyed that class. My next class was Statistics and I took that as a summer class because I wanted to have the same professor as I had for Algebra II. I also made an A in that class, and I missed the first week because I was on vacation. I came back and I got caught up, and I just enjoyed it. I really, really enjoyed it. (Faith, Int. 2, 519-524)

Peyton seemed surprised that she could succeed in college mathematics, with two A's and a B in the courses she took. She gives credit to the teacher:

> Even though it [the college courses] was Algebra I and II and Statistics, the subjects in itself is [sic] extremely hard, but coming from a very poor background, meaning 10$^{th}$ and 11$^{th}$ grade, I was very fortunate to have a very good college professor meaning that he explained and you understood which is why I rated those the way I did. (Peyton, Int. 4, L. 399-402)

Despite the fear and avoidance of mathematics, through their somewhat inadequate mathematics backgrounds, they were finally able to experience success in mathematics.

The success of the three women in college mathematics might be attributed to an exceptionally easy instructor had they not all had different teachers. Instead, several factors, I believe, helped them in a course that they obviously feared at the beginning. First, the three women all spoke of their mathematics instructors as being excellent or outstanding teachers. Both Faith and Peyton appreciated the teacher explaining in ways that they understood (Peyton, Int. 4; Faith, Int. 3). Perhaps the lecture style of the college mathematics classroom suited their learning styles or the high level of content knowledge possessed by the professors resulted in a higher quality of lesson presentation. Presumably an entire hour of mathematics was presented and discussed, instead of the teacher providing examples for the first 5 -10 minutes of class and then the students spending the rest of the class on an assignment as some of their middle school and high school classes were organized. In addition, the women were older and more at ease with asking questions of the professor and classmates. Faith remembers: "Also I think it was feeling

more comfortable working with my friends. I made some outstanding friends in college, and I just felt comfortable working with them" (Faith, Int. 1, L. 531-532).

In a national report relating teacher quality to student achievement, Darling-Hammond (2000) stated, "Strong research support has linked student learning to variables such as teacher clarity, enthusiasm, task-oriented behavior, variability of lesson approaches, and student opportunity to learn criteria" (p. 10). Additional links include the teacher's ability to interact with the students using higher order questions and student-generated ideas in mathematics. Tying teaching style to class preferences, a lecture with good explanations and examples seems to match learning preferences of lower class students (Payne, 2001; Theule-Lubienski, 1997). Working in groups with peers is an effective strategy for all students, but females seem to thrive in a cooperative mode of learning (Koontz, 1997). And students in areas of poverty, such as Appalachia, may profit from forming relationships with the teacher and with classmates, making it easier to receive academic support (Payne, 2001).

*Teacher Quality*

All three of the women encountered dreadfully ineffective or incompetent teachers in mathematics at more than one point during their public school years which, without a doubt, had a detrimental affect on their learning, attitudes, and confidence levels in mathematics.

> But in my case I had so many teachers that were negative toward their whole attitude about learning they weren't enthusiastic and to me I don't think they had the excitement that they should have had. (Laura, Int. 3. L. 106-108)

> I have bad math memories from $4^{th}$ – $6^{th}$ grade. As far as the competition, having difficulty understanding the material. I had what I felt like was two very weak teachers in $5^{th}$ and $6^{th}$ grade and that's really when I began to really dislike math. (Faith, Int. 1, L. 146-149)

> I still think once you have a bad teacher one year, no matter when it is, that still has a great impact. (Peyton, Int. L. 635-636)

The problem of teacher quality is not unique to Appalachia, but perhaps the magnitude of the problem is the same as other areas of persistent poverty (RAND Mathematics Study Panel, 2003).

> Lack of finances translates into classrooms without teachers; classrooms through which up to seventeen substitutes parade in a semester, and teachers who are so unqualified that they neglect their pupils academically, abuse them psychologically, and destroy their self esteem. (Ambert, 1998, p. 76)

While high-quality teachers are most important to the success of students in areas of poverty, teachers in those areas are least likely to have the content knowledge and pedagogical skills (Kaplan & Owings, 2002). With the school system serving as the largest employer in many poor rural districts, the hiring of teachers and other school personnel can be highly political, meaning that teachers may be hired for reasons other than competency, and firing or reprimanding teachers who are not doing their jobs is almost unheard of (Schrag, 1976).

> Historically, schools in Appalachia have been controlled by local elites and manipulated for political ends. Schools have been a major institutional arm of the colonization of Appalachia, participating in the denigration of regional lifestyles, perpetuating external control through discrimination and helping to insure the continued powerlessness of the Appalachian rural people. (U.M. L. Reck & G.G. Reck, 1980)

Attracting highly qualified teachers to impoverished rural areas is a problem because of lack of modern infrastructure such as housing, good roads, recreational opportunities, and shopping facilities. (Campbell & Silver, 1999). Even when the teachers are born in the area and want to remain there, they may be guilty of perpetuating the stereotypes of Appalachia through their attitudes and beliefs about the culture (U. M. L. Reck & G. G. Reck, 1980; Woodrum, 2004).

In overt and subtle ways, these females perceived that they had been adversely treated by classroom teachers. In addition to Laura's fifth grade teacher telling her that women were not supposed to be good at mathematics, she recalled another situation in high school:

> Football players would be out all night, could be out all night, and not take a test. That's fine. They would still make A's and B's in her class. People like me that would struggle and try would always make D's. (Laura, Int. 2, L. 879-881)

And although Laura liked her eleventh grade teacher's unconventional style, the outrageous behavior and stress on competition may have adversely affected other females in the class:

> He would smoke a cigarette; he didn't care. He would use profanity in class, and he used to seat you from the highest test score to the lowest and if you were in the trenches he was like a cheerleader pushing you out of the trenches. (Laura, Int.1, L. 547-550).

Faith recalled feeling uncomfortable in a male teacher's class:

> He [the male mathematics teacher] was very flirtatious with the girls who would let him be. I sort of shied away, and he was more buddy-buddy with the guys in the class. Certain students he would let get away with more. He was more friendly to those, and I think he just had his picks. (Faith, Int. 3, L. 122 -125)

Peyton remembered her Algebra teacher's lack of discipline and that the son of a prominent community member "pulled pranks on this lady all the time" (Peyton, Questionnaire). Often a good-old-boy network exists in Appalachia favoring and protecting male teachers (McFadden & Smith, 2002), even male legislators, when their behavior exceeds acceptable boundaries[13].

[13] West Virginia House Education Committee Chairman Jerry Mezzatesta remained a state delegate for 18 years before finally being convicted of crimes including collecting two taxpayer-funded paychecks from his legislative salary while in Charleston for regular and special sessions and simultaneously collecting pay as a grant-writing administrator for Hampshire County schools, even though he never wrote a grant. He also diverted funds intended for Hampshire County schools into local fire departments. (Eyre, 2004)

*Appalachian Image*

All three young women felt proud of their Appalachian heritage and the experiences of small town rural life close to family while growing up. Yet each of them was aware of the negative images that others have about the region. Laura, the only one of the three to work or go to school outside the area, encountered blatant bias toward her Appalachian background. Yet she feels it her duty to "dispel the myth they have of us" (Laura, Int. 1 L. 849). She related her observations:

> [The university] is the place that I really saw where I come from was problematic for some people to understand because people were very surprised that someone like me, from Appalachia, with a southern twang, could be intelligent enough to come to [the university]. You know, we're supposed to be on four-wheelers and drinking moonshine and acting crazy. (Laura, Int. 1, L. 836-840)

Faith felt fortunate to have an Appalachian literature class which helped to affirm her family's coal mining connections. When I ask her how people from this area are viewed, she, too, expressed the desire to take a stand:

> As hicks, uneducated, bare foot and pregnant, things like that. I hate it because I'm all the time feeling like I have to defend the region where I'm from because there's always, "You hillbilly this, you hillbilly that," and I have to come up with some quick response to put them in their place but it's just I hate the way that we are viewed. I really do. (Faith, Int. 4, L. 146-150)

Peyton highly values the skills she learned from growing up in Appalachia, such as canning and gardening, and the emphasis on local history which she loves. She did not express any negative views that outsiders to the area might hold, but defended her place of residence which she perceived to be smaller community within the region. "Well, are you familiar with the small town? There are really no streets, you just have the paved road. And we were lucky enough to have stripes on the road, so we're not that back woods" (Peyton, Int.1, L. 107-109).

Negative stereotypes can have a profound effect on an individual's own identity and intellectual performance (Steele, 2004). Towers (2005) studied West Virginia youth and how their views of the Appalachian stereotype influenced their preferred place of residence in order to address the issue West Virginia's problem of the out-of-state migration of its young adults.

> As feared by many West Virginians, these stereotypes channel dissatisfaction with their state and discourage young residents from staying home and contributing to the state's future. Ironically, while those outside West Virginia who are inclined to apply Appalachian stereotypes within the Mountain State,…the locals, themselves targeted by outsiders' clichés, insist on inflicting Appalachian stereotypes on their fellow West Virginians. (p. 82).

"The Southern Coalfields [region of West Virginia]….is rated by those expecting to out-migrate as the worst place to live in the state" (p. 82). The young women in this study grew up and attended public schools in or very near to the Southern Coalfields region, which seem to have a particularly negative image.

Determining the degree of influence of the Appalachian culture on the education, especially in mathematics, of these young women is difficult to ascertain. The community factors of culture, socioeconomic levels, and rural isolation, combined with the effects of race, gender and ethnicity in the individual, impacted opportunities to a quality education. All three of the women had very loving and supportive families who valued education and saw it as means to a better quality of life. Family played a tremendous role in the achievement of their college degrees. All three experienced years of excellent teachers in mathematics and of horrendously incompetent, neglectful, or abusive teachers in mathematics. They all were affected adversely by those bad years, but how and to what extent, it is difficult to say. Perhaps that less than adequate mathematics background resulted in reluctance to ask questions in mathematics class, a refusal to take additional mathematics courses in high school, and a disappointing score on the *Praxis I* - Mathematics test.

The inadequate mathematics background of the woman may have been the result of living in Central Appalachia, but not entirely because of the Appalachian culture. According to Keefe, G. G. Reck, and U. M. L. Reck (1989), Appalachia shows evidence of having a distinct ethnicity in the cultural, structural, and symbolic dimensions, but those characteristics are intertwined with socioeconomic class and rural place of residence. They concluded: "With regard to education, it is the powerful combination of Appalachian ethnicity, lower class status, and rural residence that seems to ensure that students drop out" (p. 218). Although the three women in this study did not drop out of school, like many of their classmates, they dropped out of mathematics long before they were given the choice not to take it any more.

*Summary*

The women in this study faced similar obstacles in learning mathematics, many of which were related to the socioeconomic level of the schools they attended and the rural isolation of the areas, both of which were impacted by the Appalachian culture. These obstacles included ineffective or damaging teaching practices, especially at the middle and high school levels, low teacher expectations, lack of institutional support for extra help to succeed in higher mathematics course, and lack of advisement as to what high school mathematics courses they should take in high school and why. Some of the poor classroom instruction was most likely the result of direct or indirect gender bias, most notably in Laura's case who also endured racial bias, creating "negative beliefs related to their competencies and the likelihood of success" (Stipek & Gralinski, 1991, p. 370). Having adequate, even excellent, teachers during some years could not close the gap in their mathematics learning, as evidenced by their fairly recent performances on the *Praxis I* Mathematics test, nor could it change their negative feelings about mathematics which was only reinforced by their scores on that test.

Nevertheless, these stories are ones of hope and success. All have graduated from college, unlike many of their peers; all have passed the *Praxis I* Mathematics test, and all are employed in a teaching job for the coming school year. Several factors, including ones based on Appalachian culture, contributed to their ability to overcome the obstacles. First and foremost, the support of their parents and family was critical in providing support for education and for teaching them the values of hard work and perseverance. Parents offered encouragement when school problems became overwhelming and, at times, they intervened on their behalf to change school administrators' decisions or school policy. The Appalachian kinship tie, which may in some cases discourage students from succeeding educationally (Keefe, U. M. L. Reck, & G. G. Reck, 1983), worked to their benefit in having parents and family members who expected them

to finish college. All of them had, at different times, particularly encouraging teachers whose efforts helped the women to achieve their goals. Of course, none of the women would be where they are today, had they not had the willingness and motivation to work toward their goals, even when discouraged by the difficulty of mathematics classes and lack of teacher interest. In a way, the acknowledgement of the Appalachian stereotype motivated them to prove it false by excelling educationally. The ability to persist in the face of adversity perhaps derives from an Appalachian history of hard work in the face of isolation and exploitation (Towers, 2005; Woodrum, 2004).

# Chapter Eight

## Conclusions and Implications

By their very nature, life stories do not lend themselves to broad generalizations, but if we look closely enough, they may reveal tiny diamonds of insight that warrant a closer look. In the case of these three young women, I was privileged to take an intimate journey with them as they navigated back through the memories and impressions of their lives in public school in Central Appalachia. After listening to their stories of teachers' careless words or lack of interest in them as human beings, I am sure I will be a better teacher, one who realizes that an unthinking dismissal or a condemning word might live on well beyond the moment in ways I could not have imagined. Likewise, words of encouragement offered to students or small caring acts done for them may seem inconsequential at the time, but they undoubtedly live and grow.

The mathematics education received by all the women was, at best, inconsistent as demonstrated by their self-created graphs of mathematics ability and confidence (Figures 1, 2, & 3), their life story accounts of their school experiences, and their difficulties in making the minimum required score on the *Praxis I* Mathematics test. Apparently these inconsistencies arose from problems relating to mathematics education in general, or mathematics education in areas of rural poverty, or mathematics education for female or African American students, all of which appeared to be further impacted by the Appalachian culture. Further examination of these connections can provide an impetus for additional research to inform and improve policy and practice.

### *Connections to Mathematics Education*

Ball, Lubienski, and Mewborn (2001) posed the question, "Why are so few American adults mathematically proficient?" (p. 434) highlighting a problem with a national emphasis. "The school mathematics experience of most Americans is and has been uninspiring at best, and intellectually and emotionally crushing at worse" (p. 434). The mathematics that the women in this study experienced was primarily textbook-based, and they had almost no recollections of manipulatives, projects, group work, or connections to real life or to other mathematical topics. And while being taught in a transmission model may be typical (National Research Council, 2002), it is far from ideal, and likely contributed to their fragile and shallow mathematical understandings. (Hiebert, 1999, 2003)

#### *Standards-based Mathematics and the Role of Language.*

The problem of inadequate mathematics instruction was brought to public attention back in 1989 by the National Research Council who recommended the *Curriculum and Evaluation Standards for School Mathematics* (National Council of Teachers of Mathematics, 1989) as a model for mathematics curriculum and instruction. Since that time, the National Council of Teachers of Mathematics has published an updated *Principles and Standards for School Mathematics* (2000), and *Standards*-based[14] mathematics has dramatically influenced state and local curriculum, textbooks, instructional methods, assessment, and evaluation (Kilpatrick et al., 2003). In *A Research Companion to Principles and Standards for School Mathematics* (Kilpatrick, et al., 2003), numerous scholars review the literature for many aspects of *Standards*-

[14] Refers to mathematics teaching practices and philosophies based on the recommendations by the National Council of Teachers of Mathematics, most recently the *Principles and Standards for School Mathematics* (2000).

based mathematics, including recommendations for further study. One area of inquiry, in particular, that seemed to arise from my results is the role of language in the learning of mathematics. All three of the women had limited opportunities for discourse in many of their mathematics classes for reasons of shyness, hostile or competitive classroom climate, teacher discouragement of questions, and few opportunities for group work. Further research could include classroom observations to determine levels and quality of classroom discourse and its relationship to student learning. Interviews with teachers could determine their conscious efforts at promoting dialogue in the classroom. Studies of successful mathematics teachers could provide insight into practices and climates that enhance students' use of language. Longitudinal studies could use student interviews and surveys to determine if opportunities for classroom discourse increase or decrease as students progress in school and how it affects students' perceptions and their learning in mathematics. An aspect of teacher evaluation criteria could be that they show evidence of providing opportunities for whole class and group discussions in mathematics.

Because *Standards*-based mathematics represents a dramatic change in the way that mathematics is taught, promoting that "new" type of instruction in Appalachian may prove a bit more challenging due to an underlying localism (The Rural Youth and Family Consortium, 1996). Perhaps more than one generation within a family attended the same school, so change is harder to accept, much like school consolidation (U. M. L. Reck & G. G. Reck, 1980). Woodrum (2004) suggested that there may be a "cultural resistance" to state educational mandates, such as testing, in Appalachia due to past exploitation and a perceived difference in values from the government. Mathematics placed within the real world of the students with connections to the region may encourage acceptance of a different perspective on teaching mathematics. Research to determine what types of curricula are available for students in rural areas and which are most successful in producing deep mathematical understandings within that context could inform policy decisions on curriculum materials and professional development. Resources could be made available to teachers through the Internet and collaborative groups.

*Gender and Racial Biases.*

Although much research on gender issues in mathematics has been done, including school, teaching, parent, and internal belief variables (Leder, 1994), almost no research has studied the mathematics achievement of girls in the Appalachian culture. All three of the women in the study encountered gender bias in terms of hostile classroom environments or instructional practices which made them uncomfortable and reluctant to participate. Possible future research questions could include: Does the Appalachian culture impact mathematics learning, especially for females? Do the Appalachian stereotypes motivate the females to achieve in mathematics? Does an aspect of fatalism in the Appalachia culture heighten the idea that mathematics is ability-based and less dependent on effort? Data collected through interviews or surveys of students, parents, teachers and administrators in Appalachia and classroom observations would be an initial step to inform the gender question in this region.

Laura, as an African American, was in an extreme minority in the public schools she attended and suffered lack of opportunities, disparaging remarks, and perhaps even unfair academic tracking due to race. Her parents' teaching and her own strength and determination helped her to cope with the prejudicial actions and attitudes she experienced. Whereas areas of rural poverty, especially Appalachia, are missing from educational research, African Americans in rural poverty are represented even less. Comparing the differences in mathematical learning

experiences in both urban and rural settings could inform the greater question of how to reduce the achievement gap in mathematics for African Americans. Other questions could help improve the school experiences of African Americans in the heart of Central Appalachia. Because Laura was able to succeed so well, did aspects of the Appalachia cultural hinder yet also help her to reach her goals? Are racial biases more pronounced in the Appalachia region or did the aspects of social stratification (Keefe, U. M. L. Reck, & G. G. Reck, 1983) play a greater role?

*Difficulty with Geometry.*

Since struggles with geometry in high school appear to be a national concern, questions arise from the data in my study about the particular obstacles to learning geometry in Appalachia. Why is there a perception that one can either be good at geometry or good at algebra, but not both? Is this "either-or" attribution concerning ability in geometry and algebra common to Appalachia and to other areas? And does an aspect of fatalism from the Appalachian culture play a role? What are the perceived differences between geometry and other mathematics classes? What teaching practices and curriculum contribute to achievement and confidence in geometry and how do they compare to that of regular mathematics? Interviews with students who are successful compared with interviews of those who are unsuccessful in geometry, along with observations of teacher practices and students interactions, could provide insight into how geometry is taught and how students process it. Also, how do students' attributions of ability to geometry impact their learning?

Teachers with demonstrated competency in teaching geometry should be assigned to teach those courses in high school; the consideration of effectiveness should override scheduling decisions based on seniority or even less defensible reasons. Examination of geometry in the elementary and middle schools could determine if the curricular supports are in place for future learning. If and how teachers teach or ignore "the geometry chapter" in earlier grades could be determined through classroom observations and teacher surveys and interviews. Professional development targeting the content and pedagogy for teaching geometry for all grade levels would bring emphasis to the documented lack of geometry understandings in the country.

*Connections to Rural Poverty*

The three participants in this study were from the lower to mid-level middle class, although they lived in an area of rural poverty and, in all grades, had classmates who were poor. Poverty of the school and the geographical region impacts mathematics achievement as well as the individual poverty level of the student (Kirkpatrick et al., 2001; Secada, 1991). The indicators that Bottoms and Carpenter (2003) list as contributions to poor mathematics achievement in southern rural schools and the factors listed by Bush (2003) as affecting student achievement were all experienced by these three participants. The factors include: pedagogy involving low expectations and traditional methods, lower level course taking patterns, few opportunities for extra support, low teacher expectations, and lack of guidance and advisement. A connection seems obvious between the characteristics of schools in this area of rural poverty and the mathematics experiences of the three young women whose efforts to learn were commendable within the educational opportunities they were offered.

*Detrimental Teacher Practices.*

Poor classroom instruction and harmful teacher attitudes were paramount in the mathematics struggles experienced by the participants in this study, and while not unique to

areas of rural poverty, areas with poor working conditions have trouble attracting and retaining highly-qualified teachers (Darling-Hammond, 2003). The women in this study experienced more than one year, and sometimes consecutive years, of poor mathematics instruction which seemed to relate to their performance on a basic skills mathematics test which they all took at the end of their college years.

> Students who are assigned to several ineffective teachers in a row have significantly lower achievement and gains in achievement than those who are assigned to several highly effective teachers in sequence (Sanders & Rivers, 1996). Teacher effects appear to be additive and cumulative, and generally not compensatory. (Darling-Hammond, 2000, p. 2).

Despite having some years of good, even excellent, mathematics instruction, the women didn't seem to learn certain areas of content until faced with them on the *Praxis I* Mathematics test.

While a number of studies tie teachers' content knowledge in mathematics to student achievement (Ball, Lubienski, & Mewborn, 2001), less emphasis is placed on other less obvious factors that impact student learning and classroom climate. Although the three women inferred that some of their less effective teachers did not have the mathematics content knowledge, other teacher traits also impacted their learning and their attitudes about mathematics. Using mathematics class for activities blatantly unrelated to mathematics learning was noted by Faith and Peyton:

> My brother had the same teacher [as Faith] when he was in high school. And my brother was always an excellent student, and he had the worst time in his class. A lot of other students did as well, and I think there were some complaints made. He would have students paint ceiling tiles for extra credit, and they would have to put like mathematical equations on the ceiling tiles. I just remember my brother bringing home tons of ceiling tiles to get extra credit. (Faith, Int. 3, L. 126-132)

> After looking more at my notes, this is back to tenth grade math which was from earlier I mentioned the two teachers, and looking back I do remember some free time in class, I was French braiding a classmate's hair and then by looking at what someone had written in the year book we still had more free time. (Peyton, Int. 4 L. 124-127)

> Also this particular [high school mathematics] teacher, a couple of years later I had her sister [as a teacher] for class, and you could actually get extra credit in this lady's class and that was by when she got married clipping the local announcements out of the paper and bringing those in for extra points so of course I did that**. (**Peyton, Int. 4, L. 167-170)

All of the women in my study experienced mathematics class, at multiple points in time, in which there was little or no *opportunity to learn*.[15] "In fact, opportunity to learn is widely considered the single most important predictor of student achievement" (Kilpatrick, et al., 2001, p. 334).

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[15] "The circumstances that allow students to engage in and spend time on academic tasks such as working on problems, exploring situations and gathering data, listening to explanations, reading texts, or conjecturing and justifying have been labeled *opportunity to learn*" (Kilpatrick, et al., 2001, p. 333-334).

As with the other issues, diminished opportunities to learn in mathematics classes are not unique to Appalachia. But parents in Appalachia may be less inclined to challenge teachers who do not provide a quality mathematics education for their children. U. M. L. Reck and G. G. Reck (1980) suggest that schools are a part of a system which devalues Appalachian culture and even helps to guarantee, "The continued powerlessness of the Appalachian rural people" (p. 19). In interviews with rural Appalachian parents whose children attended the consolidated school, they concluded:

> Thus, these rural Appalachian people do not view their experience with schools as consistent with their needs. There is a feeling that schools do have something to offer their children – better jobs or a better standard of living. But there is an accompanying feeling that the schools have not delivered on this potential. (p. 22)

Though the parents of the three women in my study challenged the school for different perceived injustices, they did not speak up in every incidence. Jones (2002) identified Appalachian traits of humility, modesty, and the reluctance to confront others and traced them to the history of religious teaching in the region. While those traits may play a part in parents' reluctance to challenge principals and teachers over poor teaching, another factor could be a disenfranchisement from the school (Woodrum, 2004) resulting in avoidance of teachers and the school itself.

Since the women's graphs of mathematical ability and confidence (Figures 1, 2, & 3) showed uneven experiences in mathematics, it would be interesting to find out if other students in their region experienced the same phenomena and if students from other areas of rural poverty, urban poverty, and more affluent areas would paint the same picture. Research to find the best methods for helping students overcome a discouraging or wasted year in mathematics, when they made low grades or feel that they didn't learn anything, would help others to break the cycle of failure or disillusionment in mathematics.

In terms of removing or rehabilitating incompetent or neglectful teachers, surveys and interviews with administrators could provide data on how teachers are evaluated, how effective the evaluation instruments are, and what steps are taken when incompetent or neglectful teachers are discovered. Another interesting question could relate teacher assessment scores to the teachers found to be ineffective or detrimental to see if the tests have a predictive quality.

For policy consideration, administrators must not let teachers continue to work in the classroom if they are inordinately negligent, incompetent, or emotionally or physically harmful to students, as was experienced by the three women in at least one mathematics class during their public school education. And most importantly, these teachers should not be placed in the classrooms of low-achieving or poor students, as most often happens (Darling-Hammond, 2000). Authentic teacher evaluation should be carried out in a fair and consistent manner, using a variety of data sources, so that blatantly incompetent teachers do not remain in the classroom for generations of students and to provide for the assessment, affirmation, and growth of adequate teachers (Good, 1996).

*Learners from Areas of Poverty.*

The ideas of equity in mathematics teaching and of mathematics for all are not simple ones, nor are they easily achieved. Surely *Standards*-based mathematics teaching holds promise for providing effective mathematics for all students. Yet, an across-the-board *Standards*-based

approach to teaching mathematics may not serve students of marginalized groups, such as those from the lower class, in the best way (Theule-Lubienski, 1997). And although the women in the study were middle class, their learning styles seemed to match the culture of their school. More research should be done regarding effective mathematics teaching methods for all groups of students including females, marginalized ethnic and cultural groups such as Appalachians, racial minorities, and particularly students in areas of rural poverty (Carter, 1999). Studying teachers who are conspicuously effective with teaching marginalized groups and research of teaching by teachers in connection with a college or university holds great promise for learning about the ways that students learn and the best ways to teach them (Hollins & Guzman, 2005). In addition, students themselves can use mathematics in a critically relevant way as they determine and describe social problems in their own areas and propose solutions (Oakes, Joseph, & Muir, 2004), considering the enormous amount of social and economic problems within Central Appalachia.

*The Importance of a Caring Teacher.*

All three of the women expressed appreciation for teachers with whom they had a personal caring relationship and considered warmth and empathy an important component of being able to ask questions and to learn. Nel Noddings, in *The Challenge to Care in Schools* (1992), emphasized the importance of the teacher-student relationship; "Students, too, have to learn how to care in such relations, but their first contributions are as recipients of care" (p. 103). Promoting a culture of caring in teaching involves developing relationships over time with students and affirming a sense of place and community, strategies that need to be agreed upon rather than mandated (Noddings, 2001). The idea of caring in teaching may be particularly important to students in areas of poverty who tend to respond more to teachers who form a relationship with them over time (Payne, 2001), and Appalachian students who feel strong ties to kin and place and who are hurt by the sting of negative stereotypes (Keefe, U. M. L. Reck, & G. G. Reck, 1983).

*Appalachia and Areas of Rural Poverty in Multicultural Literature.*

Because it is virtually absent from the literature, mathematics education of students in Central Appalachia and other places of rural poverty must become the focus of scholars and educators (Bush, 2003; Keefe, U. M. L. Reck, & G. G. Reck, 1983). Lubienksi and Bowen (2000) counted and categorized more than 3,000 articles from education research journals. Finding limited research on ethnicity and class, they suggested, "These patterns raise the question of whether those who enter mathematics education careers with critical concerns about ethnicity and class are quickly discouraged" (p. 632). More importantly, the results of such studies should be published until findings about those groups no longer represent a marginalized segment of mathematics education relegated to obscure journals[16] read only by a miniscule audience and until positive solutions are being implemented in every school. How the unique aspects of rural Appalachia culture combine with learning preferences of students who also hold membership in the lower socioeconomic classes would yield rich results for the students of Appalachia as well as students in all areas of rural poverty. Other questions could revolve around the importance of teacher-student relationships and the importance of caring in Appalachian schools, especially in mathematics. Do Appalachian students and students from other areas of

[16] *Journal for Research in Rural Education* and the *Journal of Geography* are two of the journals with articles focusing on Appalachia in the last three years.

rural poverty learn more mathematics when the teacher demonstrates caring in the classroom? Classroom observations, along with student and teacher interviews could identify aspects of caring which could later be quantified and studied in relation to student achievement.

Concerted efforts to bring the most promising teachers to high-poverty schools might involve incentive pay, promotion of the intrinsic awards of teaching lower class students, providing support and resources for teachers in those classrooms, and provide opportunities for collaboration and professional development especially for teachers of marginalized students. Perhaps a masters' degree program in mathematics education could be developed especially for those who work in high-poverty schools, both urban and rural, creating a mathematics specialist in multicultural education.

Providing opportunities for preservice teachers to learn about students from different cultural groups and socioeconomic levels in rural areas could be the focus of research in teacher education. Largely ignoring rural poverty, the research emphasis is currently on urban settings (Hollins & Guzman, 2005). In the education courses I teach at Bluefield College, and especially since I began my research, I have addressed the teaching of students who live in poverty. I will be investigating more ways to promote cultural sensitivity along with ideas of social justice and equity. But pre-service teachers should be given a good foundation in multi-cultural education, especially with the populations of students that they plan to teach. At Bluefield College, studies of the Appalachian culture in relation to education should be added to that of African American and Latino American cultures along with how to implement multi-cultural ideas in a meaningful and respectful way.

One promising strategy involves constructing life stories, which, somewhat like the participants in this study, has been shown to be an effective tool in developing cultural awareness for pre-service teachers during their field experiences (Hollins & Guzman, 2005) and exploring and reflecting on their own experiences in mathematics classes (Guilaume & Kirtman, 2005; LoPresto & Drake, 2005; Ellsworth & Buss, 2000). The participants in this study expressed additional insight into their teaching as a result of reflecting on their school experiences. Laura recalled in a letter to me, "I realize that as a teacher you have to be aware of all learning styles and put yourself in place of the student. I realized I was most successful when a teacher could identify with my needs." Faith made a similar statement to me in an email, "My classroom teaching has been positively impacted by telling and reading my own school story. I did not realize how important it is to relate to the students and for them to feel comfortable before the learning process can even begin to take place." Peyton vowed, in an email to me, to make her students' experiences more positive than her own, "The teacher needs to make math come alive for the students, using manipulatives. The teacher should make their worst subject the students' best subject." Moll and Arnot-Hopffer (2005), in advocating narrative projects for student teachers, stated, "Teacher education, therefore, is a matter of developing not only technical competence and solid knowledge of subject matter but also sociocultural competence in working with the diversity of students that characterize contemporary schooling" (p. 244). Surely teacher education programs in the heart of Appalachia, such as Bluefield College, could emphasize diversity that includes the marginalized students from Appalachia.

Ongoing professional development for all teachers of mathematics of all grade levels should be based in a culturally relevant context and provide opportunities for teachers to improve their content knowledge, examine their beliefs about mathematics knowledge, and the preconceived notions about students in different ethnic and cultural groups. Using the Internet for teachers to collaborate and do research for best practices in mathematics classrooms is one of

many avenues of improving mathematics instruction in isolated rural areas. Stigler and Hiebert (1999) recommend "setting the stage for continuous improvement" (p. 129) in mathematics instruction, and the principles they suggest are ones that I would like to see adopted for professional development in culturally relevant mathematics teaching at all grade levels. Perhaps professional learning groups based on those principles, especially "Focus on Teaching, Not Teachers" (p. 133) and "Make Improvements in Context" (p. 134) would be less threatening and sensitize teachers to the effects that their everyday language and actions has on student learning and attitudes. One promising practice for a staff development model to promote teachers' collaboration and reflections upon their own teaching is lesson study. "In lesson study, groups of teachers meet regularly over long periods of time (ranging from several months to a year) to work on the design, implementation, testing and improvement of one or several 'research lessons'" (p. 110).

*Assessment.*

The women in the study were impacted by assessments in two ways; they were held accountable for having the mathematics knowledge and skills to make the minimum score on the *Praxis I*, a standardized test. But the schools in the state requiring this test failed to prepare them adequately, despite their obvious efforts to learn. In addition, their standardized test scores and teacher-made assessments from grades kindergarten through twelfth showed adequate progress in mathematics. But even before facing the *Praxis I*-Mathematics test which highlighted the deficiencies in their mathematics content knowledge, they sensed that they did not know or understand mathematics according to their self-drawn graphs and explanations.

Due to the inequities in educational opportunities for students, all standardized assessments from Virginia *Standards of Learning* tests to *Praxis I*, must be scrutinized for discrepancies in performance for students of various ethnic, racial, and cultural groups, including those students in areas of poverty. Tuerk (2005) conducted a quantitative study of achievement scores in Virginia in relation to poverty, teacher quality, and community context, and suggested that these types of studies are more accessible now due to the data generated in response to No Child Left Behind legislation. Ideally, alternate assessments that capitalize on the strengths and abilities of marginalized students should be recognized and implemented. That not being the case, however, extra support for students who struggle with these tests, especially in mathematics, should be funded. In the classroom, teachers should use assessments which go beyond testing a surface ability to manipulate numbers and symbols, and investigate student conceptual understanding through alternate means, such as interviews, written responses, and concept maps (Gay & Thomas, 1993; Wilson & Kenney, 2003).

*Defining the Aspects of the Appalachian Culture that Affect Learning.*

Little research exists on schools in Appalachia, on identifying cultural aspects of the Appalachian culture, and on relating student learning to the Appalachia culture, and most of what is there is over 25 years old. Although Appalachia is a diverse region and the cultural traits differ from region to region, and family to family, documenting those traits from the perceptions of native Appalachians would provide an authentic source. Ethnographic studies of different regions could also help inform the debate on whether Appalachia is truly a distinct culture, aside from the "culture of poverty" (Lewis, 1969, p. 188). Comparative cultural studies across different areas of persistent poverty could help to differentiate what is unique about the Appalachian culture and what variables impact learning, positively and negatively.

*The Use of Life Stories to Study Learning Experiences.*

The use of life stories to study learning experiences provided an in-depth and holistic perspective to the public school experiences of the participants. This method allowed me to discover contextual variables that influence learning, to see public school life through the perceptions of the ones who experienced it, and to place learning along a continuum of cumulative events. Life stories from those who attended public school have the potential for identifying teacher words and deeds which, if they have been long remembered, have the most impact on student attitudes and learning in either a positive or negative manner. In addition, constructing life stories can help to validate the memories and perceptions of all students.

To understand if schools in Appalachia have unique challenges and contributions to mathematics education, continued interviews and life histories with students and teachers and classroom observations from different parts of the region could provide a basis for surveys of larger samples. In addition to success stories, like those of the three women in the study, a special emphasis should be made to learn the stories of those whose disengagement with school and with mathematics may have negatively affected them in their adult lives: high school dropouts, workers in low wage jobs, and the unemployed. Perhaps those stories could help us determine what role the schools have in keeping students in school and in creating life-long learners.

*Summary*

Studying the life stories of the three young women from Central Appalachia revealed preventable obstacles to mathematics learning which, in turn, revealed problems of mathematics education in general and especially of mathematics education in areas of rural poverty. In both instances, aspects of the Appalachian culture, such as familism, localism, and fatalism, impacted or amplified the effects of those problems. In the cases of the three participants, the most obvious variable in the mathematics education equation, however, was the classroom teacher. Darling-Hammond (2000) emphasized the role of the teacher in a review of teacher quality and student achievement: “Like other studies cited earlier, this research indicates that the effects of well-prepared teachers on student achievement can be stronger than the influences of student background factors, such as poverty, language background and minority status” (p. 35).

Connections to mathematics education and the current *Standards*-based reform emphasis include questions about opportunities for students, especially females, to participate in mathematical discourse through class discussion, group work, and questions asked of the teacher. These women were often reluctant to speak in class due to gender issues or their own shyness which may have adversely affected their learning. All three recalled incidences of gender bias with Laura also distinctly remembering racial prejudices, which negatively affected educational opportunities, classroom climate, and teacher behavior. The Appalachian connections to these issues may have included an atmosphere of male dominance which perpetuated microinequities in the classroom for female students. In addition, all three women struggled with geometry. The Appalachian trait of fatalism could have influenced the students’ attributions in mathematics toward a natural ability rather than effort.

Connections to the problems of education in rural poverty included a number of incompetent or abusive teachers, sometimes over consecutive years. In addition to the difficulties of attracting teachers to high poverty areas is a social stratification within the Appalachian culture and a possible reluctance of parents to challenge school or teacher practices.

An immediate need exists to remove or rehabilitate teachers whose instructional practices are damaging students year after year. As for learning preferences, students from areas of poverty tend to prefer a teacher who offers good explanations, much like the descriptions of a good teacher by the women in this study. The women also stressed the importance of a caring teacher which relates to learners in poverty as well as emphasis placed on relationships within the Appalachia culture.

Like literature on mathematics education in areas of rural poverty, research on mathematics education in Appalachia is sparse. With a perpetual achievement gap between learners who are affluent and learners who are poor, research is needed to examine the obstacles to learning mathematics in Appalachia and to propose solutions. Because aspects of the Appalachian culture that impact learning are not well-defined, qualitative studies are needed for exploration to identify those and to complement larger-scale ethnographic and quantitative studies. To that end, life story research can reveal traits that are present within a culture while validating the experiences of individuals who represent a marginalized segment of society, the Appalachians.

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Appendix A
Informed Consent

# Informed Consent for Participants in Research Projects Involving Human Subjects

***Title of Project:*** *Learning Mathematics in Central Appalachia: Life Histories of Current and Future Elementary Teachers*

Investigator(s): Donna Hardy Watson Advisor: Dr. Jay Wilkins

**I. Purpose of this Research/Project**

The purpose of this research is to explore the informal and formal educational backgrounds, especially in mathematics, of current and future elementary teachers who have grown up in Central Appalachia, an area of rural poverty.

**II. Procedures**

You, as a participant, will be asked to:

- Write a reflective paper of any length you choose on your learning experiences in public school.
- Provide available past standardized test data, Praxis I score reports, college and public school transcripts, and any other documents indicating school or mathematics achievement. These will be photocopied, and the originals will be returned to you.
- Provide photographs, newspaper clippings, or other materials of your choice relating to your life during your public school years. These will be photocopied, and the originals will be returned to you.
- Participate in at least one, but no more than 4, audio-taped interviews, lasting from 60 to 90 minutes each, with the researcher in the education division classroom or her office at Bluefield College, or another mutually agreed-upon location, or by telephone over a 12-month period beginning in February 2005, scheduled at the participant's convenience.
- Correspond by email, regular mail, or telephone calls to submit questions and comments about the interviews, questionnaire, or the research process.

**III. Risks**

The research procedures present no more risk than you would expect to have in everyday activities. If you, at any time, become a student in any course I teach, you will not be penalized in any way for participating in this study or for choosing to withdraw from the study.

**IV. Benefits**

As a participant, you will receive no direct benefit from being in this study.

**VII. Freedom to Withdraw**

You are free to refuse to answer any question or any part of a question and free to refuse to provide any information or documents. You are free to withdraw from this study at any time without penalty by leaving a message by telephone or email with: Mrs. Jennifer Thorn,

Administrative Assistant, Division of Education, Bluefield College (Phone: 1-276-326-4242; Email: jthorn@bluefield.edu)

**V. Extent of Anonymity and Confidentiality**

Due to the nature of qualitative research, I cannot guarantee absolute confidentiality although I will take the following measures to protect your identity. Your name and the names of all participants and places in this study will be kept in strictest confidence by the use of pseudonyms, and no specific identifying characteristics will appear in any publication or presentation of the research results. At no time will I, the researcher, release data from the study to anyone without your written consent. The recordings, transcripts, and documents will be kept in a locked file in the researcher's office at Bluefield College or in a locked file in the researcher's home office, and I and my advisors at Virginia Tech will have the only access. I will return the copies of your documents to you, or shred them, will erase the tape recordings and email messages when the research process is completed.

After I transcribe the audiotapes, you will be given the opportunity to read the transcripts in order to clarify, expand, or correct your comments.

**VIII. Approval of Research**

This research project has been approved, as required, by the Institutional Review Board for Research Involving Human Subjects at Virginia Polytechnic Institute and State University, by the Department of Teaching and Learning.

**X. Subject's Permission**

I have read and understand the Informed Consent and conditions of this project. I have had all my questions answered. I voluntarily agree to participate in this study. I hereby acknowledge the above and give my voluntary consent:

_____ _____Date_____

Subject signature

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

Donna Hardy Watson(Investigator)_____ __ 304-325-2366/dhwatson@vt.edu

Dr. Jay Wilkins (Faculty Advisor) 540-231-8326/wilkins@vt.edu

Dr. Jan Nespor_ (Departmental Reviewer/Department Head) 540-2318327/nespor@vt.edu

Dr. David M. Moore, Chair, IRB; Office of Research Compliance; Research & Graduate Studies 540-231-4991/moored@vt.edu

**You will be given a complete copy (or duplicate original) of the signed Informed Consent.**

# Appendix B
# Interview Protocol

Interview 1: School and Mathematics Memories

**Using Questionnaire 1:**

1. Describe the best memories (and worst) memories of school in general (and mathematics) in elementary school? In middle school? In high school? In college?

2. What did you like best about mathematics? What did you like least about mathematics?

3. What are your greatest strengths in mathematics? Greatest weaknesses in mathematics?

4. What did you like best about mathematics? What did you like least about mathematics?

**What did teachers do in each grade level to teach mathematics? What types of instructional strategies were used? What kinds of materials and technology were used? Describe the classroom, the feelings and images you see in your mind's eye.**

**What mathematical topics you can remember learning in school. Which ones were your most favorite? Your least favorite?**

When did you first learn these mathematical topics? (If you didn't learn them in school, tell me about that.) When and how often did they reappear in later years?

Describe how you learn mathematics best. What works for you? What have you tried that didn't seem to work? How did acquire these strategies?

**How important is mathematics in the real world? How does it connect to other subjects?**

**Can mathematics be learned outside of school? In what ways and by whom? In what ways did you learn mathematics at home? In what ways was your learning of mathematics reinforced at home?**

1. How did your family members view you as a student? How did your friends view you as a student?

2. What role did your family members play in your learning of mathematics?

3. Who helped you with your mathematics homework?

4. What mathematics tasks do you do on a daily/weekly/monthly/yearly basis? Which of these do you find easy or difficult? Do you use calculators or computers do solve any of these types of problems?

**Tell me about your experiences with the Praxis I Mathematics test.**

Interview 2: Community Context (Using Questionnaire 2 as a launching point).

**Tell me about the community where you grew up. How did you view it as a child? How has your view changed?**

**How would you describe Appalachia? When did you become aware of growing up in Appalachia? How did growing up in Appalachia influence your life choices? What impact has living in Appalachia had on your learning and your opportunities?**

**What types of out-of-school activities did you participate in? Which ones did you enjoy the most? What extra activities and organizations do you participate in now? How did your experiences as a child and youth influence your choice of activities that you participate in now?**

Interview 3: Home and Family Information (Using Questionnaire 3 as a launching point).

**Tell me about your immediate family. Where do they live now? What did you learn from your family? How does your family reflect the influence of Appalachian culture? What types of regular chores did you do?**

**What types of roles did family members play in your education?**

**What other activities did you do together? Did you take trips or vacations? If so, where did you go and what do you remember about those experiences?**

**What do you consider your extended family? Where do they live now? How often do you see them and in what context?**

Create a mathematics image timeline

**Using an entire sheet of paper, draw a line graph that indicates your image of yourself as capable in mathematics throughout your public school years to the present time. Use words and symbols as you like to explain the graph.**

**Explain what you mean by the graph. Why were these significant points? What experiences are attached to each of these points?**

Relational and Summary Questions:

**What influences contributed to your learning of mathematics?**

**How will the way you teach math to elementary students be the same as the way you were taught? How will it be different?**

**How does living in Appalachia impact the learning of mathematics?**

**What have you learned during the course of the interviews about how you learned and are learning mathematics?**

# Appendix C
## Interview Schedules

Participant 1: “Laura”

March 4, 2005 .....Interview 1
April 1, 2005 .....Interview 2, began self-assessment chart
April 12, 2005 .....Interview 3, completed self-assessment chart
July 20, 2005 .....Mailed response to additional question

Participant 2: “Faith”

July 20, 2004 .....Interview 1
July 28, 2004 .....Interview 2
August 4, 2004 .....Interview 3
May 15, 2005 .....Interview 4, completed self-assessment chart
July 8, 2005 .....Emailed response to additional question

Participant 3: “Peyton”

March 24, 2004 .....Sent questionnaire and consent form by email
April 6, 2004 .....Interview 1
April 13, 2004 .....Interview 2
April 27, 2004 .....Interview 3
March 8, 2005 .....Interview 4, completed self-assessment chart
July 6, 2005 .....Emailed response to additional question

# Appendix D: Questionnaire

**Questionnaire Part 1: School Information** **Date:_____**

**Directions:** Fill in as much as you can in the chart, using the back for additional memories or questions. Don't worry if you don't have something for every space.

| Grade | Teacher (or Math Teacher) | Math Grade and Math Course | School Memories | Math Memories |
|---|---|---|---|---|
| **PreK** | | | | |
| **K** | | | | |
| **1** | | | | |
| **2** | | | | |
| **3** | | | | |
| **4** | | | | |
| **5** | | | | |
| **6** | | | | |
| **7** | | | | |
| **8** | | | | |
| **9** | | | | |
| **10** | | | | |
| **11** | | | | |
| **12** | | | | |

**Questionnaire Part 2: Community/College Information** **Date:_____**

**Directions**: Please answer the following questions. Feel free to leave out information that you do not wish to share. Add any comments that you think would help clarify the information you give. Write comments or questions on the back of this sheet or on another sheet of paper if you need more space or think of other things you would like to add.

| | |
|---|---|
| 1. Where did you live growing up? Tell about each place and your age at the time. | |
| 2. What out-of-school activities were you involved in growing up? | |
| 3. What adults in the community influenced you when you were growing up? | |
| 4. Who were your best friends growing up? What activities did you enjoy doing together? | |
| 5. Did you have any jobs before you graduated from high school? If so what were they? | |

**College Information**

| | |
|---|---|
| 1. What (is) was your major? Minor? Your degree goal? | |
| 2. What math courses have you taken and what were your grades in each of them? | |
| 3. Did you have to take any non-credit math courses? If so, tell me about them. | |
| 4. How many times have you taken the PPST-Mathematics? Did you expect to pass it the first time? What are your impressions? | |

**Questionnaire Part III: Family Information** **Date:_____**

**Directions**: Please answer the following questions. Feel free to leave out information that you do not wish to share. Add any comments that you think would help clarify the information you give. Write comments or questions on the back of this sheet or on another sheet of paper if you need more space or think of other things you would like to add.

| | |
|---|---|
| 1. Who lived in your home as you were growing up? | |
| 2. Mother's Information | Occupation:<br><br>Level of Education:<br><br>Age when you were born:<br><br>Hobbies and Activities:<br><br>Special Talents and Abilities: |
| 3. Father's Information | Occupation:<br><br>Level of Education:<br><br>Age when you were born:<br><br>Hobbies and Activities:<br><br>Special Talents and Abilities: |
| 4. Brothers' and or Sisters' Information | Levels of Education:<br><br>Ages in relation to you:<br><br>Hobbies and Activities:<br><br>Special Talents and Abilities: |
| 5. Others Living in the Home when you were growing up. | Levels of Education:<br><br>Ages in relation to you:<br><br>Hobbies and Activities:<br><br>Special Talents and Abilities: |
| 6. Influential Family Members who did not live with you. | Levels of Education:<br><br>Ages in relation to you:<br><br>Hobbies and Activities:<br><br>Special Talents and Abilities: |

# Appendix E: IRB Approval, March 8, 2004

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

**Institutional Review Board**

Dr. David M. Moore
IRB (Human Subjects)Chair
Assistant Vice Provost for Research Compliance
CVM Phase II- Duckpond Dr., Blacksburg, VA 24061-0442
Office: 540/231-4991; FAX: 540/231-6033
email: moored@vt.edu

DATE: March 8, 2004

MEMORANDUM

TO: Penny L. Burge Educational Leadership & Policy St. 0302
Donna Watson

FROM: David Moore

SUBJECT: **IRB Expedited Approval:** "Case Studies of Aspiring Teachers Who Take the Praxis 1 Test in Mathematics at least Three Times" IRB # 04-115

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective March 4, 2004.

cc: File
Department Reviewer Jan Nespor T&L 0313

Appendix F: IRB Approval, February 11, 2005

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

**Institutional Review Board**

Dr. David M. Moore
IRB (Human Subjects)Chair
Assistant Vice President for Research Compliance
CVM Phase II- Duckpond Dr., Blacksburg, VA 24061-0442
Office: 540/231-4991; FAX: 540/231-6033
email: moored@vt.edu

DATE: February 11, 2005

MEMORANDUM

TO: Jesse L. Wilkins Teaching and Learning 0313
Donna Watson

FROM: David Moore

SUBJECT: **IRB Expedited Approval:**"Learning Mathematics in Central Appalachia: Life Histories of Current and Future Elementary Teachers" IRB # 05-089

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective February 10, 2005.

Virginia Tech has an approved Federal Wide Assurance (FWA00000572, exp. 7/20/07) on file with OHRP, and its IRB Registration Number is IRB00000667.

cc: File
Department Reviewer Jan Nespor T&L 0313

Vita

**Donna Hardy Watson**
**dwatson@bluefield.edu**

**Education**

| | | |
|---|---|---|
| 2005 | Virginia Polytechnic Institute and State University<br>Blacksburg, VA | Ph. D.<br>Curriculum and Instruction<br>Mathematics Education |
| 1983 | Radford University<br>Radford, VA | M. S.<br>Secondary Education |
| 1980 | Bluefield College<br>Bluefield, Virginia | B. A. in English with<br>Teacher Licensure |

**Professional Work Experience**

| | |
|---|---|
| 2005 - Present | Bluefield College, Bluefield, VA, Assistant Professor in Education |
| 1996 - 2005 | Bluefield College, Bluefield, VA, Adjunct Instructor in Education |
| 1980-1996 | McDowell County, WV, Middle School Mathematics Teacher |

**Awards and Honors**

| | |
|---|---|
| 2000 | Distinguished Service Award, "The Chair" by the West Virginia Council of Teachers of Mathematics |
| 1993 | Presidential Award for Excellence in Science and Mathematics Teaching (National Award) |
| 1991-1992 | Christa McAuliffe Fellowship Grant in the amount of $33,300.00 |
| 1991-1992 | West Virginia Middle School Mathematics Teacher of the Year |
| 1991 | Ashland Oil Teacher Achievement Award |
| 1991 | County Teacher of the Year, McDowell County, WV |

**Professional Memberships**

| | |
|---|---|
| 1986-present | West Virginia Council of Teachers of Mathematics, President 1997-1999, Newsletter Editor 1996-present |
| 1985-present | National Council of Teachers of Mathematics |
| 1986-present | Delta Kappa Gamma Society International for Women Educators |
| 1992-present | Council of Presidential Awardees in Mathematics |
| 1998-present | Phi Delta Kappa International |