To the Graduate Council:

I am submitting herewith a dissertation written by Tracie McLemore Salinas entitled "Parent and Student Perspectives on Mathematics Education in Four Rural East Tennessee Communities." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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Parent and Student Perspectives on Mathematics Education in Four Rural East Tennessee Communities

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Tracie McLemore Salinas

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DEDICATION

To my beloved husband
René
who inspired,
encouraged,
and sometimes
pushed
me through this process
and
to my family
who understand why rural education
is so important to me.

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And now that this is done, I will finally have time again to work in my gardens.

ABSTRACT

This study investigated the significance that high school students and their parents in four rural, east Tennessee communities attach to mathematics and to mathematics education in their local high schools. A questionnaire survey was administered to 2,530 students and 1,018 parents in the four participating communities. Twelve percent of student surveys and just over ten percent of parent surveys were returned. Data collected from the surveys were presented using descriptive statistics. Findings include that students in the four high schools expect to complete a higher level of education than that attained by their parents. They also aspire to or expect occupations that require a higher level of education than those of their parents. Students expecting jobs that required higher levels of education also tended to expect to take more mathematics credits than their peers. Students and parents have similar values in defining mathematical success, although parents tended to value work related mathematical skills more highly than did students. Students and parents also agreed on the primary purposes for teaching mathematics in the local high schools. Findings revealed some opportunities for future work by the participating schools, such as providing information to parents on occupational and educational opportunities for their children and addressing the mathematical curriculum to increase the number of connections made to the real world.

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CHAPTER I

Introduction to the Study

Introduction

Over the last few decades, the occupational landscape of rural America has changed dramatically. Farm populations have dwindled as manufacturing and service jobs have replaced those in agriculture (Rosenfeld, 1983; Whitener & McGranahan, 2003). Mining operations unable to satisfy government regulation have often opted to close facilities rather than rebuilding or cleaning, leaving behind many workers or, in some cases, whole communities (Freshwater, 2000). After graduation, students from rural areas often must seek employment outside of the rural community and are more likely to work in occupations requiring a higher level of study than in previous years (Elder, 1963). Furthermore, students must satisfy increasingly stricter state and local requirements for graduation with a high school diploma. No longer does the practical learning of the countryside necessarily prepare students for success after high school (DeYoung, 2002). Instead, the schooling necessary for success in rural areas has changed.

In spite of such developments in occupational and educational options or curriculum requirements, researchers have historically paid very little attention to the issues of rural education. Consequently, recent publications call for immediate attention to rural education to counter the lack of existing research (Beeson & Strange, 2003; Bush, 2003). In particular, research should consider the context of rural education and how the characteristics of that context interact with education.

Of particular interest to some researchers is the mathematics education of rural students. Practically non-existent in the research literature (Howley, 2003a; Howley, 2003b; Silver, 2003), the analysis of mathematics education in the rural context provides information crucial to providing effective mathematics instruction in rural communities (Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics, 2003). Mathematics is, of course, essential for occupational and educational success, but it is also increasingly vital to personal development and advancement. The Appalachian Collaborative Center for Learning, Assessment and Instruction in Mathematics (ACCLAIM) recognizes mathematics as "liberating and transcendent knowledge" (2003) while Moses and Cobb assert that mathematical knowledge is as essential in contemporary times for political and cultural advancement as literacy has been in the past (2001). Researchers are already plotting the way for investigations in mathematics education research in rural areas, and a number have suggested research questions or methodologies for addressing the necessary questions (Dobson & Dobson, 1987; Helge, 1986; Howley & Schulz, 2003; Kifer, 2001). All agree that with the past neglect of rural education and the increasing importance of mathematics education, the intersection of the two is a vital area of future research (Howley, 2002; Schultz, 2002).

Statement of the Problem

Although educators have in general presumed that national standards are universally applicable, they have failed to provide evidence of how these standards fit or do not fit in rural places (Howley, 2003a). In fact, very little

research has considered educational issues within the rural context or from a rural perspective at all. This study investigates mathematics education from the perspectives of rural high school students in four particular communities in east Tennessee and of their parents.

Purpose of the Study

This study is designed to investigate the significance that parents and high school students in four rural Appalachian communities attach to mathematics and to mathematics education in their local high schools. This study also explores how parents' perceptions of mathematics and mathematics education relate to students' perspectives of mathematics and mathematics education and to students' choices in high school mathematics courses in the four communities under study.

Research Questions

This study describes the significance that parents and high school students in four specific rural Appalachian communities of eastern Tennessee attach to mathematics and to mathematics education in their local high schools. Questions investigated include the following:

1. How do parents of high school students in these four rural areas use mathematics in their occupations?
2. How do rural high school students and their parents in these four rural areas characterize mathematical success?
3. For what purposes do rural high school students and their parents in these four rural communities believe mathematics is taught in their local high schools?

4. How often do parents of high school students in these four rural communities discuss their children's mathematics classes with their children?
5. What mathematics courses are rural high school students in these four communities taking and for what reasons?
6. In these four rural communities, is a student's choice of mathematics courses or perspectives on mathematics education related to his or her educational expectations?
7. In these four rural communities, is a student's choice of mathematics courses related to his or her occupational aspirations or expectations?
8. In these four rural communities, is a student's choice of mathematics courses related to his or her parents' educational level?

Basic Assumptions

In this study three assumptions were made. First, the researcher assumes that data self-reported by students and parents were accurate. Second, the researcher assumes that demographic information obtained from the United States Census Bureau, the United States Department of Education, the Tennessee State Department of Education, and the school districts involved was also accurate. Third, the researcher assumes that survey instruments were distributed by teachers as described in the information and instruction sheet provided them.

Research Methods, Procedures, and Analysis

The research method utilized was a questionnaire survey. Two surveys, one for parents and one for students, were developed following a thorough study of relevant literature. The surveys were then administered to students from four East Tennessee high schools and to a random sample of parents of those students. The survey administered to parents discovered basic demographic information, established socio-economic status, and discerned parents' perspectives on mathematics and mathematics education in their community. The survey administered to students also determined basic demographic information, recorded past and future mathematics courses taken, and discovered students' perspectives on mathematics education. Students were also asked about their educational and occupational expectations and aspirations.

Questions on the surveys consisted primarily of two types: linear, numeric scales or multiple-choice items with multiple or single responses. Two questions relating to occupational expectations and aspirations for students and a question asking for parents' occupation allowed for free response. Most data were reported numerically, although a few questions resulted in categorical data presented by descriptive statistics.

Definitions of Terms

For the purpose of this study, the following terms are defined:

1. Expectations include those career or educational outcomes that students believe are possible and likely to happen.

2. Aspirations refer to those career or educational outcomes to which students aspire but may not believe are likely to happen.
3. Rural possesses a number of definitions and connotations in the literature, so a discussion of the meaning of rural is presented. The classification for participating schools as "rural" derives from the Johnson codes used by the National Center for Education Statistics.
4. Appalachia refers to the mountainous spine that stretches from northern Alabama into southern New York. This study focuses on the area that is typically referred to as the southern Appalachians, which includes east Tennessee, southwest Virginia, east Kentucky, and West Virginia.

Limitations

Potential weaknesses in this study include:

1. Honesty of participants in answering the questionnaire.
2. Failure to include some participants who are illiterate and therefore incapable of self-reporting data on the survey questionnaire.
3. Researcher bias in analysis or interpretation of some data.
4. Non-response of recipients of surveys who are capable of completing the instrument.

Delimitations

This study examines four selected high schools in eastern Tennessee. The communities served by these high schools do not necessarily represent all rural

areas, particularly those heavily involved in agriculture. The four high schools are all located within one hundred miles of the Knoxville metropolitan area, so the degree of isolation may differ from that of other rural areas. Furthermore, the populations of the communities involved are predominately white; therefore results may not transfer to areas with different racial or ethnic composition.

It is not the purpose of this study, however, to make statements that may be generalized to a larger population than that under study. In other words, these data do not represent those of all rural areas or even of all Appalachian areas. The data is a representation only of the population immediately under study.

Organization of the Study

The study is divided into five chapters. Chapter one is an introduction to the study, addressing the problem, purpose, and need for the study. Chapter one also discusses the limitations and delimitations of the study, defines relevant terms, and presents the research questions. An exploration of the relevant literature on rural education and mathematics education appears in the second chapter, while the third chapter describes the methodology used to meet the purpose introduced in the first chapter. The findings of the study are presented in the fourth chapter with conclusions and discussions following in the fifth. Finally, a sixth chapter discusses the experience of conducting rural educational research. The sixth chapter represents a deviation from the data obtained in the study; instead, it discusses the actual experience of conducting rural research from the researcher's perspective.

CHAPTER II

Review of Literature

Introduction

In its *Principles and Standards of School Mathematics,* the National Council of Teachers of Mathematics, or NCTM, identifies equity as one of its guiding principles, championing the idea that all students should have access to meaningful mathematics education "regardless of their personal characteristics, backgrounds, or physical challenges" (2000, p. 12). Such access is vital in contemporary society as mathematical knowledge is relevant not only to many occupations but also to citizenship and daily life. A lack of mathematical knowledge "deprives [people] not only of opportunity but also of competence in everyday tasks" (Kilpatrick, Swafford, & Findell, 2001, p. 1).

In spite of the importance of mathematics and the focus on equity for students of all backgrounds, very little research exists on mathematics education in the rural context (Beeson & Strange, 2003; Bush, 2003; Howley, 2003a; Khattri, Riley & Kane, 1997; Schultz, 2002; Silver 2003). In the research, rural schools are "America's forgotten educational institutions" (Loveless, 2003, p. 10). The absence of a body of research is especially surprising since some 3.2 billion members of the world population of 6 billion live in areas that are considered rural (Silver, 2003). Some researchers assert that the lack of focus on rural mathematics education results from the general assumption that national standards are applicable everywhere with little to no concern for how they do or do not

apply to a particular social context (Howley, 2003a). This assumption exists in conflict with the ideals of NCTM, which recognizes that instruction should not be identical in all locations (2003). Precedent exists in early mathematics education research to examine how culture affects the teaching of mathematics and learning (Bush, 2003). Such an investigation seeks to "understand the meanings that the learning and teaching of mathematics have for those who are engaged in the activity" (Kilpatrick, 1992, p. 4).

Perhaps the rural locale possesses some unique characteristics that should influence the planning or researching of mathematics education. By understanding those characteristics, administrators and policymakers may have a better understanding of the learning and teaching of mathematics in rural areas (Dobson & Dobson, 1987). A review of the related research topics, including mathematics education, rural education, and rural sociology, discovers numerous studies emphasizing the need for an understanding of the role of the rural context in mathematics education.

Defining "Rural"

The word "rural" conjures up a variety of images from country to country and can even refer to many things within a single country or state (Sher, 1983; Whitaker, 1983). Difficulty in defining the term is an oft-mentioned critique of rural education research (Fan & Chen, 1999; Helge, 1986; Kannapel & DeYoung, 1999), and these discrepancies make comparisons among research studies difficult, if not entirely impossible. It is a bit simpler to understand why so many definitions exist when one considers the history of "ruralness."

In the eighteenth century, citizens of the American colonies still thought in many ways as their European counterparts did. Cities were seen as cultural centers and were generally preferred to country living. However, with the coming of the revolutionary war, Americans found themselves trying to differentiate themselves from the English. The rural lifestyle presented one option, and soon agrarianism, or rural living, became a cornerstone of the American identity. Initially, Americans did not choose the agrarian lifestyle out of philosophical reasons. They did so because of geography. The sheer abundance of land, much of it untamed, resulted in new patterns of land ownership and settlement in the New World. Thus in the earliest decades of American history, agrarianism represented a lifestyle that was uniquely American (Danbom, 1997).

In many ways, this lifestyle was seen as morally superior to that of the Europe the colonists had left behind. J. Hector St. John De Crevecour described the early Americans in his *Letters from an American Farmer*, writing:

> We are a people of cultivators, scattered over an immense territory, communicating with each other by means of good roads and navigable rivers, united by the silken bands of mild government, all respecting the laws, without dreading their power, because they are equitable. . . There on a Sunday, [a viewer] sees a congregation of respectable farmers and their wives, all clad in neat homespun, well mounted, or riding in their own humble wagons. There is not among them an esquire, saving the unlettered magistrate. There he sees a parson as simple as his flock, a farmer who does not riot on the labor of others. We have no princes, for whom we toil, starve, and bleed; we are the most perfect society now existing in the world" (Crevecour, 1995, p. 310).

Crevecour's idyllic America did not last. The divide between rural and urban lifestyles grew with the industrial revolution. Literature bore witness to the

conflicts of ideology arising from societal changes and sought to make sense of the directions the country seemed to be taking. The nineteenth century saw the development of regional writing, a way of preserving ways of life peculiar to certain parts of the country "before industrialization dispersed or homogenized them" (Baym, Franklin, Gottesoman, Holland, Kalston, et al, 1995, p. 1187). America changed over the span of some fifty years from "a rural, agrarian, isolated republic whose idealistic, confident, and self-reliant inhabitants for the most part believed in God" into "an industrialized, urbanized, continental nation whose people had been forced to come to terms with the implications of Darwin's theory of evolution as well as with profound changes in its own social institutions and cultural values" (Baym, Franklin, Gottesoman, Holland, Kalston, et al, 1995, p. 1181). The result was that the United States began to focus its policy-making on its urban inhabitants and communities.

Rural areas and, in particular, rural schools did receive some attention in this period, but since "the rural problem" was difficult to define, little progress was actually made. For example, the shift of the nation's population to cities, including large numbers of immigrants, brought concerns about traditional methods of school organization, which were seen as "haphazard, inefficient, and inappropriate" (Rosenfeld & Sher, 1977, p. 13). Social reformers and educators, including Horace Mann, secretary of the Massachusetts Board of Education, pushed for state control of public education. Their ideas were met with opposition, particularly in newly settled areas of the country. These areas tended to develop school systems that did not resemble those of New England but

differed depending on geography and population. Often, the school structures adopted in the newly-settled areas did not lend themselves to effective centralization. Nonetheless, states began framing educational policy in terms of state control of and responsibility for schooling of children. Rural communities, which typically resisted the loss of local control associated with centralization, were seen as backward-thinking or otherwise problematic. Their hesitation in accepting the new centralized model of schooling was deemed selfish, overly conservative, or simply ignorant (Rosenfeld & Sher, 1977). In spite of the reluctance of many rural areas to adopt a centralized school structure, by the late 1890's the notion of a large, centralized school district became the standard model (Kannapel & DeYoung, 1999). The foundation of American education had been laid; schools would be "centralized, standardized, and professionally administered" (Rosenfeld & Sher, 1977, p. 21). The model for schooling had changed from rural to urban, and the means of evaluation had as well. As a result, rural schools were compared to their urban counterparts in ways that favored the urban schools. Rural schools were suddenly deemed inferior and their students at a serious disadvantage (Rosenfeld & Sher, 1977).

Some years later, President Theodore Roosevelt created a commission to consider problems associated with the nation's rural population. The report provided by the commission described the migration of promising rural students to cities, leaving an unstable agricultural class behind (Theobald, 1995). Consequently the Country Life Commission was created and charged with two goals: "1) infuse a love of the countryside with an experience-based curriculum,

and 2) consolidate country schools into one central location" (Theobald, 1991, p. 21). This plan, a concept akin to Dewey's ideas of real learning, failed to stem the tide of out-migration of bright students from rural areas, and the loss of promising young people continued during the twentieth century (Theobald, 1991).

At the same time the rural population of the country was changing, the definition of the word "rural" was also changing. Rural places had been classified as such because of their level of isolation, low population density, and dependence on agricultural production. However, the 1938 publication of *Urbanism as a Way of Life* by sociologist Louis Wirth pushed rural sociologists to describe rural areas in other ways, but no agreed-upon description of "rural" was created (Whitaker, 1983).

"Rural" came to be defined more by what it was not than by what it was. The U. S. Bureau of the Census had in the late 1800's used the classification for counties of fewer than 8,000 inhabitants. By 1980, the definition of rural disappeared. Instead, "urban," or metropolitan, was defined as communities of more than 2,500 persons. Rural was simply the classification for locations that did not fit the definition of urban (Rios, 1988). A more complex system for classification established by the United States Department of Agriculture considers both population size and the urban orientation of an area. The system uses ten categories, four of which distinguish among metropolitan counties and six of which distinguish among nonmetropolitan counties based on their nearness to a metropolitan area and population size (Stephens, 1992). This classification system is still used today.

Defining Rural for Educational Research

The notion of rural has been used to describe sparsely populated areas or those in which agriculture played a key role in the local economy. However, for the purpose of rural educational research, rural communities cannot simply be described by their population density or by their economic classification, although these characteristics do have important consequences for education. Just as important is an understanding of the mindset of rural communities. In this way, "rural" represents a way of life or a philosophy, not just a population classification.

Paul Nachtigal explains that the nineteenth century principles of industrialization were standardization, specialization, and centralization (Nachtigal, 1982), all of which were reflections of conflicts in contemporary American society. Standardization reflected the desire to assimilate immigrants, specialization the evolution of task-oriented processes in industry, and centralization the development of a new hierarchical structure for the industrial model (Rosenfeld & Sher, 1977). These three ideals were in disagreement with the deep-seated notions of the agrarian lifestyle, which could better be described as generalized and decentralized. Farming and other occupations grew more mechanized as the twentieth century came, introducing the ideals of the industrialized society to the context of the agrarian (Rosenfeld, 1983). Still, rural communities managed to some extent to maintain their local identities.

Unfortunately that local identity is frequently seen as a deficiency, both in economic and educational terms. Educational research demonstrates this view, as explained by Craig Howley:

> If, for instance, the topic is statewide reform, again, the focus of effort is likely to be the special backwardness or challenges of rural places in acceding to the reforms, not the disjunction between local and state priorities. If the topic is student aspirations, the focus is likely to be how rural schools can best "increase" the level of students' aspirations, not the relationship between student commitment to rural life ways and cosmopolitan ways. If the topic is the dropout rate, the focus of effort is most likely to be strategies for retaining or retrieving students rather than the disjunction between rural schools' national purposes and the nature of local rural economies (Howley, 1997a, ¶ 20)

Thus, the rural context is frequently seen less as a resource for education than as an inadequacy to be overcome. A "sinister" result, according to Howley, is that in this light, school becomes "the ultimate charity for rescuing students from deficient lifeworlds" (2003a, p. 218). A clearer understanding of these lifeworlds is necessary. Thus, rural researchers have sought to create better definitions of "rural" so that questions of more depth than those of school size or class size may be addressed (Whitaker, 1983). In addition, they have supported the idea of examining various rural areas, recognizing that although they may have some common characteristics, they are also quite different.

Rural Appalachia

Although rural communities across the nation may share some characteristics, it is wholly unjust to assume that all rural is alike (Bush, 2003). In fact, quite the opposite is true. Rural America is much more heterogeneous than one might expect and therefore eludes a single definition or stereotype (Marion,

1979; Sher, 1977; Stephens, 1992). One distinct rural area is that of south and central Appalachia, usually defined as the mountainous spine that runs through east Tennessee, southwest Virginia, east Kentucky, and West Virginia (Drake, 2001). The area has remained largely isolated until late in the twentieth century and continues to suffer from some of the highest poverty and illiteracy rates in the United States (Bush, 2003).

Clear descriptions of Appalachian life remain somewhat elusive. In spite of the collaboration of "geographers, geologists, botanists," and others, "serious studies of the life and culture of the region's people have been astonishingly slow in developing" (Drake, 2001, p. 129). Practically all agree, however, on the painful economic history of the area.

Before the conquest of coalfields in central Appalachia, the area had a "Cohee" culture in which a yeoman-style agriculture dominated. Hence, families lived on isolated farmsteads in scattered rural communities, grazed cattle and hogs in forests but farmed in cleared areas, and had as centers of their social lives county seat towns and community churches. Yeomanesque farming was not commercially oriented and disappeared under the influence of capitalism from most parts of the United States by the mid 1800's. However, it lingered in the most remote areas of Appalachia well into the twentieth century when it could no longer compete with the goods and higher standard of living promised by the coal markets (Drake, 2001).

The machine age came early to Appalachia, seeking the coal to fuel its industrial fires, but rural Appalachia was left little in return (Duncan, 1986).

Appalachians dealt with "an extractive economy that first created exploitive, low-paying and low-skill jobs, then eroded them through decades of mechanization" (DeYoung, 2003, p. 13). Even in the late twentieth century unemployment rates for central Appalachia averaged ten to twelve percent annually as compared to a national average of two to seven percent. The unemployment rate in some locations actually climbed to twenty percent, and with bleak outlooks for the coal industry and tobacco farming, there is currently little promise for economic growth in the near future (Drake, 2001; Harvey, 1986; Tompson, Berger, Allen, & Roenker, 2001).

Economies in many rural areas depended entirely on agriculture, forestry, or mining, industries that have changed dramatically in recent decades. Typically, areas that depend on natural resource extraction industries must rely on heavy reinvestment of private funds to realize true economic growth. Because of the low wages generally associated with such work, little reinvestment occurs within a community from its own wages. Further, company ownership tends to exist outside the community in which workers reside and to have few connections with the community itself. Thus, minimal reinvestment in community growth is made by the corporations whose profits come from the removal of natural resources (Duncan, 1986). Rural poverty, then, tends to be concentrated in the areas that these industries left behind (Khattri, Riley, & Kane, 1997). Central Appalachia, which was strongly tied to coal mining, has suffered a great deal (Johnson & Broomhall, 1992). The area lost both jobs and money immediately and eventually lost population as well (Whitener & McGranahan, 2003). From 1940 to 1970,

some three million people left Appalachia looking for jobs in the industrial cities of the northeast (Drake, 2001).

Because of its rocky landscape, the Appalachian region was already home to one of the least dense populations in the United States, which, coupled with the rocky terrain, increased the degree of isolation in the area and prohibited the development of strong infrastructure systems (Appalachian Regional Commission, 2003). Hence, local communities generally remained close-knit (Bush, 2003), and resisted definition by any urban measure. As one writer describes it,

> Mountains, wider than they are tall, staved off travel, communication, and outside influences. Cash was scarce and the notion that quality of life was somehow linked to dollars was foreign to most people. The way a man lived depended on his energy, self-sufficiency, and ability to join together with others like himself (Shackelford & Weinberg, 1977, p. 18).

This closeness to kin results in a clannish community, but even in small Appalachian communities, sociologists and anthropologists find some differentiation among families, usually based on family reputation, income, and the "degree of urban sophistication" (Drake, 2001, p. 184).

Appalachian communities regularly confront stereotypes created by the media, literature, and lore. On the one hand, the Appalachian is said to represent all the best of traditional America, the "historic individualism, its self-sufficiency, and self-sacrifice" while on the other, it represents the worst in America, its "gun-toting violence, its poverty, the exploitation of the environment, its welfare-dependency, its superstition, and its racism" (Drake, 2001, pp. 217-218). Drake

notes that Appalachia has been reinvented by politicians, social critics, and intellectuals over the years for their own purposes, resulting in a hodgepodge of damaging stereotypes for the area. Those familiar with the area recognize the narrowness of these portrayals (Drake, 2001).

Research in Rural Education

Research in the mid twentieth century considered the changing requirements of education and employment, noting that scholastic achievement and college preparation would likely become more important to youth. Since a large proportion of low status urban jobs would draw rural citizens to the cities for employment, even rural youth found educational attainment crucial for eventually advancing their occupational opportunities. Nonetheless, at that time rural students were also at what appeared to be a disadvantage. Many were less well prepared than their non-rural counterparts for college, and they typically chose completely different fields of study (Elder, 1963). Even in more recent years, data reveals that a relatively small percentage of students from rural high schools were enrolled in post-secondary education. For example, for every one hundred suburban high school graduates, sixty-seven apply to college; of one hundred urban students, sixty-three apply to college. However, of every one hundred rural high school graduates, only fifty-seven apply to college (Loveless, 2003).

High academic achievement was rarely the norm in American education for much of United States history. Relatively new is the notion that the purpose of education is to liberate the individual from the community in search of personal upward mobility (DeYoung, 2003). Here, then, is the conflict so often witnessed

in rural communities, that of local control and the needs of the community versus the national economy and personal occupational success (Bush, 2003; Dunne, 1983; Kannapel & DeYoung, 1999). The same conflict plagues schools, where the adoption of urban values is often in direct opposition to community values or where national standards defy local control (Kannapel & DeYoung, 1999). These conflicts sometimes develop into ridiculous, almost humorous, circumstances. For example, the Iowa Department of Public Institutions spent years trying to enforce legislation requiring every high school in the state to offer two years of foreign language study for students. Frequently, no students wanted to enroll in the courses. Furthermore no community college or four-year institution to which most students applied even required the two years of foreign language for admission. Eventually the requirement was dropped (Dunne, 1983).

The history of close family ties and of economic challenges in rural areas lends itself to research in the effects of poverty and of parental influences on student academic achievement. In fact, much previous work has focused on these particular aspects of rural education, as well as on the aspirations and expectations of rural students.

Socioeconomic factors

In the 1960's several studies considered the effects of poverty on educational decision-making and achievement. A 1967 study by Sistrunk sought to determine differences among low-income rural communities in value placed on education. Parents and students in ten rural Kansas counties completed questionnaires administered by the researchers. In addition, the researchers

monitored local newspapers to compare coverage of academic and athletic events in the communities. The study revealed that students who were college-bound were more likely to say that their parents were interested in the students' future plans. Students also believed that academic success was very important to their mothers and somewhat important to their fathers; questionnaire data for parents revealed that it was mostly somewhat important to both (Sistrunk, 1967). In a separate study, Elder reported that low-income parents interviewed were more likely to expect their children to go to college if they lived near a low-tuition community college (1963). Larson and Slocum also found modestly positive results, reporting in a study of rural Washington families that they found much weaker support than expected for their hypothesis that poverty leads to a rejection of societal values, including education (1969).

Research continued in the 1970's into the interaction of socio-economic status, parent expectations, and students' educational choices and achievement. Davies and Kandell completed a study in the early 1970's that considered 762 adolescent-parent-best friend triads. The triads were developed following the administration of questionnaires to students in five schools and the selection of students and parents willing to participate. Results indicated that the influence of parents on their children's occupational and educational aspirations was stronger than that of their peers. Furthermore, socioeconomic status was the strongest determinant of a parent's aspirations for his or her children. In this way, socioeconomic status had only an indirect influence on students' aspirations although it had no statistically significant direct effect (Davies and Kandel, 1981).

Oberle and Campbell conducted a study of 1,413 household heads in the Ozark Mountains in which they found partial support for the idea that parental values may actually mitigate the limitations of low socio-economic status for educational attainment (1970).

Although much research has considered the effects of poverty on student performance, it is still unclear how similar or dissimilar rural poverty and urban poverty are (Carter, 1999). Most data available on student outcomes are not disaggregated by both location and by poverty levels, making it impossible to clearly discern the relationship of outcomes of students in poor, rural areas to those in poor, urban areas (Khattri, Riley, & Kane, 1997). In addition, although there was an abundance of research on the aspirations of youth in the 1960's and early 1970's, there has been very little since. The result is a lack of information on the aspirations of females, minorities, and students from lower socio-economic situations (MacBrayne, 1987).

Aspirations and expectations

Rural children are generally thought to hold much lower aspirations and expectations for their futures than children in suburban or urban areas, regardless of their socio-economic status. However, a 1960 study by Morland discovered that lower income children may have had lower educational aspirations but did not have lower occupational aspirations. Perhaps, he suggested, the lower-income children simply did not understand the relationship between educational success and occupational opportunity (Morland, 1960). Just a few years later, Larson and Slocum explain that students from low-income families are much less likely to be

interested in school, enrolled in a college preparation program, or even receive encouragement from teachers to go to college (1969).

Rural, low income students were examined in a study that considered the effects of structural and social psychological variables on occupational plans. Data were collected in 1969, 1975, and 1979 from students in five southern states, including Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. Eighteen schools were ultimately determined to meet the researchers' criteria for having high poverty and high area unemployment. The school sample represented 954 individuals, 447 of whom were followed through all three phases of data collection. Thus students were initially contacted as fifth or sixth graders in 1969, as seventeen to nineteen year olds in 1975, and as young adults in 1979. At each phase, respondents were asked about the jobs that they hoped to eventually have and the jobs that they expected to have. National Opinion Research Center codes were used to identify the relative prestige of occupations. Respondents' IQ's, educational plans, and academic motivation were also assessed.

Data revealed that occupational aspirations diminished slightly over the ten-year period, but occupational expectations declined dramatically. The resulting question is why young adults "continue to aspire to occupations that they do not expect to attain" (Farris, Boyd, & Shoffner, 1985, p. 66). Furthermore, females were more likely to have higher status projections for their occupation aspirations, expectations, and plans than males. Race, family background, and IQ

were reported to have little practical importance in explaining the occupational plans of the rural respondents (Farris, Boyd, & Shoffner, 1985).

In a study of data from the United States Department of Education publication *High School and Beyond* (HSB), Hanson found that sixteen percent of all youths regardless of location had lower expectations than aspirations and that twenty-seven percent had expectations that decreased over time. Consequently, students who expect a college degree while in high school have lowered expectations a few years after graduation for obtaining a college degree. This was especially true for females, who were significantly more likely than men to aspire to but not expect a college degree. Hanson refers to the resulting loss of college graduates as "lost talent" and reports that socio-economic status has the strongest influence on deterring students who aspire to college from actually going (1994).

Similar results were discovered by Haller & Virkler. Using the data from the 1980 HSB survey, Haller & Virkler examined 20,637 students from rural schools. The data provided a measure for students' socioeconomic classification as well as information for educational and occupational aspirations. The researchers found that rural and nonrural students have very similar occupational aspirations, although rural students tended to pick fewer professional and technical jobs. Instead, many were more likely to select blue collar jobs than their nonrural counterparts. On the other hand, rural students were much more likely to select the occupation of school teacher. Furthermore, researchers determined that about half of the differences observed in rural and nonrural students' aspirations can be accredited to socioeconomic status (1993).

Parent influence

Although some researchers find little support for strong parental influences (Wigfield, 1983), others repeatedly verify the role of parents in shaping students' educational choices (Brody, Stoneman, & Flor, 1995; Jayaratne, 1987; Kandel & Lesser, 1970; Tocco, 1971; Yang, 1981). Not surprisingly, then, rural educational research discovers similar results.

McCracken and Fails randomly selected four schools in rural Ohio in which they conducted panel studies and administered surveys. They found that all students whose mothers had gone to college also planned to attend college. They also discovered a significant relationship between gender and salary expectations, with females expecting lower salaries than males in the future (McCracken & Fails, 1991).

A survey of students, parents, and school staff completed in twenty-one high schools in twenty-one states considered the role of parental and teacher expectations on students' achievement and educational decisions. All three groups of participants, students, parents, and school staff, considered personal qualities to be more important to future success than academic achievement. In spite of this finding, respondents ranked community leadership and civic responsibility low among factors necessary for successful adulthood. The researchers report, "apparently rural youth have bought into the material achievements of the faceless, placeless, metropolitan aura of superficiality . . eif rural communities are hinging their future on the leadership and activism of local

youth, it is not reflected in the perceptions of rural students, parents, and teachers" (Ley, Nelson, & Beltyukova, 1996, pp. 139-140).

Similar results are found in earlier work by Cobb, McIntyre, and Pratt who examined and compared rural and urban students. They found that rural students valued jobs more and academics less than their urban and suburban counterparts; they also were much less likely to think that their parents expected them to go to college after high school. Rural students reported that their high school teachers and guidance counselors did not encourage them to go to college and demonstrated less confidence in their ability to complete college (1989).

Outmigration: The "bitter harvest"

The problem of outmigration discussed earlier is also a common topic in rural educational research. Authors point to the development of jobs in urban areas as a major draw for rural students and as an encouragement for additional education or training (Reid, 1989). Others ask whether rural youth must make the decision to leave home to find educational and occupational opportunities. Donaldson approaches the question by suggesting that the "personal and cultural sides of rural outmigration have received inadequate attention" (1986, p. 121). The developmental dilemmas of rural youth are not well understood, he asserts, and so developmental theory fails to provide an appropriate assessment of rural adolescence. In fact, using current developmental theory to analyze the growth of rural youth to adulthood produces the startling conclusion that the "rural youth who remains in his/her native community is less likely to mature into a healthy adulthood than his/her counterpart who leaves" (Donaldson, 1986, p. 122).

Research on Education in Appalachia

As expected, research in education in the Appalachian region finds some of the same influences on students' educational and occupational decisions and achievement as in other rural areas. Attitudes toward education are "significantly related to the level of income, size of family, occupational aspiration, and family influence" (Nafziger, 1971). However, there are some notable differences as well.

For example, a 1993 study in Kentucky, North Carolina, and Tennessee sought to extend research on the educational and occupational attainment of rural Appalachian females. Researchers conducted a ten-year longitudinal study in the three states, surveying a purposive sample of females in grades five, six, eleven, and twelve and again in early adulthood. The results were strikingly different from those of similar studies in other areas of the country. Rural Appalachian females appeared to be much less affected by typical female contingency variables, such as family life-cycle and family development variables, but were much more affected by family of origin variables. In other words, the primary predictors of female attainment were father's education level and daughter's perceptions of parental expectations. High school achievement was also found to fail as a predictor of occupational or educational attainment. This result was due in some part to the pressures that Appalachian girls tend to face to accept more traditional, less prestigious "female" jobs and to put career second to family (Wilson, Peterson, & Wilson, 1993).

An earlier study in Appalachia focused on student ambition, namely on the factors relating to varying degrees of ambition among low-income youth and on how mothers may influence their children's ambition. This study was one part of a larger study carried out to examine three subcultures in the South, namely urban African-Americans, rural African-Americans in the Delta, and rural whites in Appalachia. Two hundred seventeen children and their mothers, all from 3 communities in one county of North Carolina, participated in the study. Each participant completed a questionnaire survey at the beginning and at the end of the study; in the intervening period, an experimental group of mothers and their children participated in group sessions in which they were taught about their career opportunities. At the conclusion of the program, researchers administered the same survey again, which considered aspirations and expectations for children and knowledge of career opportunities. Rural white mothers demonstrated a slight increase in knowledge of career opportunities, compared with a slight decrease for urban mothers. Rural black mothers showed a stronger increase in knowledge. Also, female students showed some decrease in the prestige of jobs for which they hoped, although male students showed little change (Shoffner, 1975).

Studies in rural education have also addressed the issue of school size. The move to consolidate smaller rural schools remains under fire, not only from those who fear loss of control and community identity but also from those who assert that small schools serve students more effectively.

Howley utilized the method of Friedkin and Necochea (1988) to analyze the small rural schools of West Virginia. Schools and districts were units of analysis, with third, sixth, and ninth grades particularly under examination. Data on school size and socioeconomic status were collected from *Common Core of Data* (National Center for Education Statistics, 1994), and student achievement was measured using data from the NCES *School District Data Book* (NCES, 1995). Howley discovered that school size interacts with socioeconomic factors to influence achievement of West Virginia students. Smaller schools seemed to be more effective than larger schools in educating students of low socioeconomic backgrounds, while larger schools seemed to be more effective than smaller schools at educating students from higher socioeconomic backgrounds (Howley, 1996). Thus, although smaller schools may offer fewer curricular options than their larger counterparts (Barker, 1985), they may in fact be serving their constituencies pretty well.

Some researchers have analyzed the experience of rural students in adjusting to the college or university atmosphere, particularly first-generation students. Darling conducted such a study, focusing on the university experiences of eight rural, southern Appalachian students who were first-generation college attendees. She discovered, in this phenomenological study, that all eight shared certain characteristics, such as a desire for personal relationships with faculty, a proficiency in hands-on learning, and need to relate learning to previous experiences. These characteristics, she explained, influenced their gravitation toward certain majors (Darling, 1999).

Research in Rural Mathematics Education

Mathematics has been called a "gatekeeper to higher education" (Howley, 2003a, p. 216). As such, mathematics is necessary for occupational and educational advancement, both on the individual *and* community level. After all, a less educated work force is a deterrent to developing or attracting industry (Johnson & Broomhall, 1992). and strong economies require strong, educated communities (Berry, 1986). While most researchers and educators would agree with these statements, rural schools are sometimes accused of being incapable of providing the education that their communities require for economic and educational success. The very aspects of the rural schools that are sometimes praised as strengths – small sizes, focused curricula, locally-born teachers – are at other times criticized as weaknesses.

For example, rural high schools are generally seen as second best because of their inability to offer as many courses as their larger suburban and urban counterparts (Barker, 1985; Melnick, Shibles, & Gable, 1987). Of particular note are results of a study by Barker that compared curricular offerings in large and small schools across the United States. Using Statistical Analysis System (SAS) computing software, Barker conducted a Chi-square analysis to determine the significance of difference reported between the frequencies of each course offered in the two samples. The frequency of offerings of four mathematics courses tested significant at the 0.05 level, namely Advanced Geometry, Calculus, Computer Math, and Probability and Statistics. In other words, these courses were offered significantly less frequently in smaller schools than in larger schools

(Barker, 1985). A logical consequence for many educators is that rural students are shortchanged in their high school education. The research is not so clear cut as this.

A 1993 study by Haller, Monk and Tien began with the hypothesis that the more extensive curricula a school offered, the greater the development of higher-order thinking skills in mathematics and science. The base-year sample of 2,829 students was composed of tenth graders from fifty-one schools across the country. Students, their teachers, and their parents completed survey instruments, and the students also completed achievement tests in 1987, 1988, and 1989 to measure their mathematics and science knowledge. The tests were based largely on items developed by the National Assessment of Educational Progress, or NAEP. Using the three classifications of cognitive processes for NAEP test items, the researchers were able to measure student scores on specific problems that required "integrating" knowledge, or higher order thinking skills.

As one might expect, the "higher the average number of semesters of advanced courses taken by students, the higher the school mean on the tests of higher-order skills" (p. 69). Also, school-level achievement in tenth grade proved a strong predictor of achievement in twelfth grade. However, researchers also discovered that school size, and therefore the number of courses offered, had no influence on student achievement in higher-order skills. Small and rural high schools "are apparently the equals" of larger schools in teaching higher order thinking skills to students (p. 66). They conclude, "While large schools offer more advanced courses than do small ones, those offerings appear to have no

influence on average levels of student achievement" (p. 71). In a review of related literature, Khattri, Riley, and Kane concur, stating that research suggests that rural students are not at the disadvantage in taking core subjects that might be expected (1997).

Looking at eighth grade mathematics data from the 1992 and 1996 NAEP, Lee and McIntyre considered state-level variation in rural and non-rural achievement. Their results revealed that, although there were no significant differences in the 1992 data, in 1996 there was a statistically significant difference in achievement scores that actually favored rural students nationally. The researchers found, however, that in seven of the thirty-five states, namely Georgia, Kentucky, Maryland, North Carolina, South Carolina, Virginia, and West Virginia, nonrural student aggregate scores were higher than those of rural students. This conflicted with national data, so their study continued to assess how a comparison of conditions might reveal the reason for variation. Regression analysis of the six identified conditions across the thirty-five states discovered that they do in fact account for the variation. That is, "rural students in states where they have access to instructional support, safe/orderly climate, and collective support tend to perform better than their counterparts in states where they don't" (2000, p. 171).

Fan and Chen identify five sources of inconsistency in previous rural research: 1) sampling issues, 2) unclear definitions of "rural," 3) lack of consideration for socio-economic status, 4) lack of distinction among ethnicities, and 5) omission of public or private classifications of schools. In their 1999

study, they analyze data from the National Education Longitudinal Study of 1988 (NELS:88) for students in grades eight, ten, and twelve in reading, math, science, and social studies while working to overcome the previously identified potential sources of inconsistency. Fan and Chen concluded that there was no systematic evidence that the eighth grade rural students performed any differently than did metropolitan students. Similar results were observed for tenth and twelfth grade students as well. When the data was broken into regions, however, one difference was observed. There was a slight advantage in favor of eighth grade students from rural schools in the Mid-West region (Fan & Chen, 1999).

Thus, these three studies of rural mathematics performance support the notion that rural schools are not failing their constituents. Instead, "it seems likely that mathematics achievement in rural and small-town schools has converged with national averages" (Howley, 2003b, p. 2).

Summary

Rural educational research has been "misunderstood, underfunded, unencouraged" (Sherwood, 2001) for far too long. The mobilization in recent years of researchers and organizations to pay particular attention to the rural context and education that occurs within it promises to develop the malnourished field.

Still, the difficulty of promoting rural programs in the face of an urban majority is daunting. In economic development as well as in education, rural communities are often expected to "find a strategy that is acceptable to the urban majority. . . [although] urban America has become increasingly suspicious of rural

decisions and behavior" (Freshwater, 2000). Fortunately, some researchers and policy makers are asking if rural areas must be held to the same standards as urban ones or if urban questions are necessarily appropriate for rural answers. For example, MacBrayne asks if status attainment, which is often the measure of students' occupational plans, is an appropriate measure for comparisons. Perhaps, she suggests, happiness, lifestyle, and quality of life, are much more interesting and appropriate indicators (1997).

CHAPTER III

Methods and Procedures

Introduction

The present study utilized a questionnaire survey. Surveys were administered to students at four high schools in east Tennessee and to a random sample of parents of those students. The resulting data were analyzed using descriptive statistics to characterize the perspectives of parents and students in rural communities.

Research Questions

This study intends to describe the significance that parents and high school students in four specific rural Appalachian communities of east Tennessee attach to mathematics and to mathematics education in their local high schools. Questions investigated include the following:

1. How do parents of high school students in these four rural areas use mathematics in their occupations?
2. How do rural high school students and their parents in these four rural areas characterize mathematical success?
3. For what purposes do rural high school students and their parents in these four rural communities believe mathematics is taught in their local high schools?
4. How often do parents of high school students in these four rural communities discuss their children's mathematics classes with their children?

5. What mathematics courses are rural high school students in these four communities taking and for what reasons?
6. In these four rural communities, is a student's choice of mathematics courses or perspectives on mathematics education related to his or her educational expectations?
7. In these four rural communities, is a student's choice of mathematics courses related to his or her occupational aspirations or expectations?
8. In these four rural communities, is a student's choice of mathematics courses related to his or her parents' education level?

Description of the Population

Four high schools in east Tennessee participated in the research study. Each of the four high schools is classified under one of the three rural categories used by the Johnson Codes used by the National Center for Education Statistics and the United States Department of Education, and each is situated in a county classified as Appalachian. Although in many ways the communities served by these high schools are similar, there are also distinct differences among them. Descriptions of the individual schools and communities follow.

School A

School A is classified as a rural school outside a metropolitan area (National Center for Educational Statistics, 2003). A comprehensive high school in a county-wide school district, it serves a population of over 1,000 students in grades nine through twelve in a district of 8,000 students. The curriculum offers a

variety of courses, including a number of vocational and technical courses. Agreements with a local community college provide students opportunities to earn college credit for some coursework while a relationship with a technology center allows access to a variety of vocational and technical courses. More than two-thirds of the students in the district receive free/reduced meals. Less than one percent of students are non-white (Tennessee Department of Education, 2003).

The county served by School A has a total population of fewer than 40,000 persons, and the high school is located in the most populous area. The county is crossed by an interstate highway, but for the most part the terrain of the county is quite mountainous. The ease of travel via interstate and location of some recreational parks make it a destination for campers in the region, although tourism is not a primary industry. The economy of the county is non-specialized, meaning that there is a variety of industry and employment (Cook & Mizer, 1989). Of the employed population, nearly one-fourth works in manufacturing. Other primary businesses are construction, retail, and education, health, and social services. The median annual household income is just over $25,000, but one-fifth of the population lives under the poverty level (United States Census Bureau, 2003). In fact, because of an unemployment rate fifty percent higher than the United States average and a poverty rate more than twice the United States average, the county has been labeled as persistently distressed by the Appalachian Regional Commission (2002). Among the population aged twenty-five years or more, sixty-five percent possess a high school diploma or more education (United States Census Bureau, 2003).

School B

School B is classified as a rural school within a metropolitan area (National Center for Educational Statistics, 2003). It is located in a larger school district than the other schools in this study but is located well outside of the densely populated parts of the metropolitan area. However, its characteristics are somewhat different from those of the other four participating schools. For example, although there is little diversity in the other high schools, School B has an enrollment of eighty-three percent white students, thirteen percent African-American students, and about one percent each of Asian, Native American, and Hispanic students (United States Census Bureau, 2003). The school has an enrollment of approximately 900 students, one third of whom are eligible for free and reduced meals (Tennessee Department of Education, 2003).

The community served by School B lies outside of a metropolitan area but is connected by a major highway and interstate to the city center. Consequently, nearly half of employed workers over age sixteen work in the central city area, and most of the rest work within the metropolitan area. The county in which School B is located is considered transitional by the Appalachian Regional Commission (2002), although census data suggests that this area lags behind other parts of the metropolitan area in educational attainment and income (United States Census Bureau, 2003).

School C

School C serves a district within a county that also has its own school district, although any students from within the county may enroll. The school has

partnerships with a number of organizations and institutions of higher education that allow for various opportunities for students and faculty. Students choose from a technical path or university path, the mathematics requirements varying somewhat between the two. School C has an enrollment of fewer than 400 students in grades nine through twelve in a district serving some 1,400. More than ninety-nine percent of the students in the district are white, and just over half receive free/reduced price meals (National Center for Educational Statistics, 2003).

The county in which School C is located is a rugged one, the tell-tale cupcakes of old mining sites still visible on mountain tops. Coal production decreased dramatically in the 1980's, and currently less than 3% of employed persons are involved in mining or other natural resource industries. Rather, a third of all jobs are in manufacturing; another fifth are in education, health and social services (Census Bureau, 2003). In the county, less than 70% of adults have a high school diploma or more education. Among persons aged 16 to 19 years, some seventeen percent are not enrolled in school and do not have a high school diploma or equivalent. The median household income for the county is under $16,000 (Census Bureau, 2003). Because of low levels of educational attainment and persistent high levels of poverty, the county is classified as distressed (Appalachian Regional Commission, 2002) and has a policy designation of persistent poverty by the United States Department of Agriculture (Cook & Mizer, 1989). The county does not host any portion of an interstate, and so is somewhat more isolated that the county in which School A is located.

However, the location of a state park partially within the county brings some visitors to camp or hike.

School D

Similar to School A, School D also serves a county-wide district but for a smaller population. In grades nine through twelve, School D has an enrollment of fewer than 800 students. Also, although School A is located in a small city, School D is in a small community at the intersection of two state highways. Student characteristics are similar to those at School C as they are both in the same county. More than ninety-nine percent of students are white, and more than half of the students are eligible for free and reduced lunch (National Center for Educational Statistics, 2003).

Description of the Data-Gathering Instrument

Because of the lack of previous research in placing mathematics education within a rural context, an existing instrument that suited the study could not be found. Therefore, following an extensive review of related literature, the instruments were created.

Student survey

The student survey (See Appendix A) is a four-page instrument consisting of fifteen items. The first page is a parental consent form that requested parent permission for student participation. Demographic information collected included students' grade level, gender, and the educational levels and occupations of their parents. This information allowed for comparisons among students at different grade levels, between males and females, and with regard to socio-economic

status. In addition, students responded to items regarding their choices of mathematics courses and the reasons for those choices. Students also responded to items similar to those on the parent surveys about the purpose of mathematics instruction in the local high school and about the amount of time spent talking about mathematics courses with parents.

The student survey consisted primarily of two item types, namely linear, numeric scales or multiple-choice items with multiple or single responses. Thus, most data were reported and coded numerically. The items requesting occupational aspirations and expectations were free response.

Parent survey

The parent survey (See Appendix B) is a four-page instrument consisting of eight items. Two items requesting occupation and gender were used to collect demographic information for the sample of parents in each community. The demographic information allowed for comparisons among parents using those variables. The other seven items collected information that would allow the parents' perspective on mathematics education to be characterized. Items requested information on the amount of time parents spent talking with their sons or daughters about mathematics, about the importance of mathematical success for their sons or daughters, and about the purpose of mathematics instruction in the local high school.

Similar to the student survey, the parent survey consisted primarily of two types: linear, numeric scales or multiple-choice items with multiple or single

responses. Most data were reported and coded numerically. The item asking for parents' occupation allowed for free response.

Field test

The survey was field tested at a small rural high school in an east Tennessee county that did not also contain any of the schools participating in the study. This high school is also located in a mountainous, rural community with course offerings similar to those of the participating schools.

Results of field test

The surveys were administered to a single class of twenty-seven students, and each student survey had a parent survey attached to it. The students carried the surveys home to be completed and returned to the school on the following day. Twenty-five students returned surveys as did 16 parents, representing a response rate of 93% for students and 59% for parents.

No problems were reported with the reading of the survey directions or items, although one survey was completed incorrectly. Consequently, only minor rewording of two items occurred following the field test of the two surveys.

Collection of the Data

Once the survey instruments were created and field-tested, preparations were made for the collection of data in the four participating high schools. The steps for the collection of data include the distribution of the survey, coding of the data, and analysis of data.

Distribution of the survey

Surveys were to be administered to all students at each of the four high schools and to a random sample of the parents at each school. To accomplish this, the following steps were taken.

First, student surveys were created for each high school. This involved creating a list of mathematics courses for item number two that was individualized for each school. In addition, the bottom of each survey was labeled with the name of the high school.

Next, the student population at each school was obtained and used to measure an appropriate size for a random sample of parents (Krejcie & Morgan, 1970). This number represented the number of surveys that would be distributed to parents. To create the random sample, the student population size was divided by the recommended random sample size of parent surveys. The resulting number, n, was used to generate the random sample by attaching a parent survey to every n^{th} student survey beginning with student survey number k. The number k was found by randomly generating a number in the interval [1,n] using a random number table (Alreck, 1995). After discussing the distribution of surveys with each high school principal, a time for distribution was selected for each school, and an estimate of students on campus at that time was made. That estimate represents the number of student surveys actually distributed at each school. For the parent surveys, a sample size was created for each school based on the student enrollment at that particular school (Krejcie & Morgan, 1970).

Table 1 demonstrates the approximate enrollment at each participating high school and the number of each type of survey distributed at the schools. In total, 2,530 student surveys were distributed, and 1,018 parent surveys were distributed.

A primary concern in the preparation of surveys for distribution was the avoidance of inconvenience for students and teachers. Therefore, the next step was to consult with principals and superintendents to create a method of distribution and collection that was satisfactory to all. Principals were particularly interested in minimizing the amount of classroom time invested in distributing and completing the surveys. Also, one school district requested that a method of dissemination of surveys be developed that eliminated the use of student or parent addresses. Thus, mailing the surveys was not a satisfactory means of distribution.

Table 1: Enrollment and numbers of surveys distributed for each high school.

	School A	School B	School C	School D	Total
Student Enrollment	1300	900	400	800	
Student Surveys Distributed	900	700	330	600	2530
Parent Surveys Distributed	298	280	190	250	1018

Working with administrators, the following method of distribution and collection was developed and carried out. Student surveys with the attached parent surveys were bundled into packs of twenty-five to thirty. Two manila envelopes, one labeled for the return of completed student surveys and one for completed parent surveys, were stacked beneath the surveys. Finally, a teacher instruction sheet (See Appendix C) was fastened to the top of each bundle. The bundles of surveys were delivered to each high school where principals assisted in placing surveys into the mailboxes of teachers who taught first period classes. Boxes labeled for the return of the manila envelopes of completed surveys were left in the teachers' workroom.

The teachers distributed the surveys to students in their first period classes on the subsequent day and kept the manila envelopes available for the collection of completed surveys for a period of five school days. At the end of five school days, the teachers returned the manila envelopes to the boxes in the workrooms. Finally, the researcher collected the boxes at the end of the five days.

Because of a low initial response rate, a second round of distribution and collection was completed. The researcher contacted each school again, collecting any remaining completed surveys and providing additional ones for redistribution.

In the initial distribution and collection, 194 completed student surveys and 66 completed parent surveys were returned. Following the second round of collection, 299 student surveys and 106 parent surveys had been returned. This represented a response rate of 12% for the student surveys and 10.4% for the parent surveys, or an overall combined response rate of 11.4%. Table 2 presents

given a numerical value that could be recorded and manipulated using statistical software.

To compare occupational aspirations and expectations of students and careers of parents, a three-tier scale was created, based on a similar scale used by Haller and Virkler (1993). Tier one contained jobs that required a college degree, tier two those jobs requiring a high school diploma or additional training, and tier three those jobs that did not require a high school diploma. Thus careers were categorized according to these tiers.

Analysis of the Data

Data were divided into two categories for analysis. These were demographic information and perspectives on mathematics education. Demographic information included the gender of parents and students, the grade level of students, the educational and occupational plans of students, and the educational and occupational status of parents. These variables were used to categorize respondents and make statements about particular segments of the population. Data classified as perspectives on mathematics education were used to characterize, usually by frequency or percentages of responses, the views held by respondents.

Spreadsheets of data were created in Microsoft Excel to allow for the manipulation of the data. Since descriptive statistics were the only methods of analysis employed, no additional statistical software was used.

CHAPTER IV

Presentation and Analysis of the Data

Introduction

The purpose of this study was to describe the significance that parents and high school students in four specific rural Appalachian communities of eastern Tennessee attach to mathematics and to mathematics education in their local high schools. The following research questions guided data collection and analysis:

1. How often do parents of high school students in these four rural communities discuss their children's mathematics classes with their children?
2. How do rural high school students and their parents in these four rural areas characterize mathematical success?
3. How do parents of high school students in these four rural areas use mathematics in their occupations?
4. For what purposes do rural high school students and their parents in these four rural communities believe mathematics is taught in their local high schools?
5. What mathematics courses are rural high school students in these four communities taking and for what reasons?
6. In these four rural communities, is a student's choice of mathematics courses related to his or her occupational aspirations or expectations?

7. In these four rural communities, is a student's choice of mathematics courses related to his or her educational expectations?

8. In these four rural communities, is a student's choice of mathematics courses related to his or her parents' educational level?

Data were obtained through the use of a questionnaire survey administered to students in those four high schools and to a random sample of their parents. This chapter presents the data collected from the survey and subsequent analysis.

The Student Survey

The student survey (See Appendix A) is a four-page instrument consisting of fifteen items. The first page is a parental consent form that requests parent permission for student participation. Demographic information collected included students' grade level, gender, and the educational levels and occupations of their parents. This information allowed for comparisons among students at different grade levels, between males and females, and with regard to socio-economic status. In addition, students responded to items regarding their choices of mathematics courses and the reasons for those choices. Students also responded to items similar to those on the parent surveys about the purpose of mathematics instruction in the local high school and about the amount of time spent talking about mathematics courses with parents.

Demographic information

The breakdown of students by gender, item number two, revealed that just over one-third of respondents were male and two-thirds were female. Item number one on the student survey, grade level of respondent, allowed for students to be categorized in this way as well. Table 3 shows the number and percentage of respondents by gender and grade level.

About a fourth of respondents were sophomores. Nearly 27% of respondents were freshmen, and 28% were juniors. Seniors represented the fewest respondents, with only 21% reporting that grade level.

Item number fifteen on the survey requested students to report on the educational levels of their parents. Students selected from several categories the one that represented the highest level of education attained by their mothers and fathers. As Table 4 demonstrates, 57% of the students' mothers had a high school diploma or less. As for fathers, just over 60% had a high school diploma

Table 3: Response by gender and grade level for student surveys.

Grade level	Male		Female		Total	
	N	%	N	%	N	%
Freshman	27	9.0	53	17.7	80	26.7
Sophomore	33	11.0	41	13.7	74	24.7
Junior	28	9.4	55	18.4	83	27.8
Senior	20	6.7	42	14.0	62	20.7
Total	108	36.1	191	63.8	299	100.0

Table 4: Highest level of education attained by parents as reported by students.

	Mother		Father		Total	
Highest level of education attained	N	%	N	%	N	%
Less than high school	46	15.4	61	20.4	107	17.9
High school diploma	124	41.5	120	40.1	244	40.8
Certificate from a trade or vocational school	40	13.4	34	11.4	74	12.4
Two-year degree	28	9.4	18	6.0	46	7.7
Four-year degree	24	8.0	17	5.7	41	6.9
Graduate or professional degree	15	5.0	13	4.3	28	4.7
Don't know	19	6.4	28	9.4	47	7.9
Unreported	3	1.0	8	2.7	11	1.8

or less. Nearly 23% of mothers had either a certificate from a trade or vocational school or a two-year degree, compared with just over 17% of fathers. Parents having a four-year degree or more included nearly 13% of mothers and about 10% of fathers.

The Parent Survey

The parent survey (See Appendix B) is a four-page instrument consisting of eight items. Two items requesting occupation and gender were used to collect demographic information for the sample of parents in each community. The demographic information allowed for comparisons among parents using those variables. The other seven items collected information that would allow the parents' perspective on mathematics education to be characterized. Items requested information on the amount of time parents spent talking with their sons

or daughters about mathematics, about the importance of mathematical success for their sons or daughters, and about the purpose of mathematics instruction in the local high school.

Demographic information

As with the student surveys, there were more female than male respondents to the parent surveys. Table 5 demonstrates that 29.9% of respondents to the parent survey were male while 68.2% were female.

Item number seven requested parents to provide the title of their occupation. The most commonly given occupations were nursing, teaching, and homemaking. Other relatively common responses included truck driving and owning a business. Categorizing the occupations reported by parents using the three-tier system of educational requirements for occupations finds that less than ten percent of respondents report holding jobs that require a college degree. Table 6 provides the full breakdown of occupations of parents by educational requirements.

Table 5: Gender of respondents to parent survey.

Gender of respondents	Number of respondents	Percent of respondents
Male	32	29.9
Female	73	68.2
Unreported	2	1.9

Table 6: Education required for jobs reported by parent respondents.

Occupational expectations reported by students	Number of respondents	Percent of respondents
I. Jobs that require a college degree	10	9.3
II. Jobs that require a high school diploma and some college or certificate	49	45.8
III. Jobs that require no diploma or additional schooling	30	28.0
Unreported	18	16.8

Less than ten percent of the jobs held by parent respondents require a four-year college degree, and most of these were from parents who identified themselves as teachers. More than 45% indicated holding jobs that require some training or education beyond high school but not a four-year degree. Twenty-eight percent hold jobs primarily in service or labor for which no diploma or additional education would be required. Nearly 17% of respondents left the occupational questions, items five and six, blank as requested to do if they were currently unemployed.

Frequency of Discussions about Mathematics

Students were asked in item number seven how often they spoke with their parents about mathematics class. Students were to select the one response among five that best represented the frequency of discussions about mathematics class with their sons or daughters. The options included 1) every night, 2) two or three times each week, 3) just once each week or so, 4) less than once each week, and 5) never. Table 7 reports the responses by frequency as provided by students.

Table 7: Frequency of discussions about mathematics class with parents as reported by students.

Frequency of discussions about mathematics class	Number of respondents	Percent of respondents
Every night	27	9.0
Two or three times each week	79	26.4
Just once each week or so	60	20.1
Less than once each week	57	19.1
Never	75	25.1
Blank	1	0.3

About 44% reported that the frequency of discussions with parents was less than once each week, while only 9% reported that they spoke with their parents about mathematics class each night.

Item number three on the parent survey asked for information on the frequency of discussions of mathematics class between parents and students. Using the same choices as provided on the student survey in item number 7, parents were to select the one option that best represented the frequency with which they had discussions with their high-school aged sons or daughters about mathematics class. Full results for the parent surveys are provided in Table 8. Eleven percent of parents reported talking with their sons or daughters more often than once per week, and 13.5% reported that they speak with their sons or daughters about once per week about mathematics class. Interestingly, 74% of

Table 8: Frequency of discussions about mathematics class with son or daughter as reported by parents.

Frequency of discussions with parents	Number of Respondents	Percent of Respondents
Every night	2	2.1
Two or three times each week	9	9.4
Just once each week or so	13	13.5
Less than once each week	35	36.5
Never	36	37.5
Blank	1	1.0

parents reported speaking with their sons or daughters less often than once per week about mathematics class, but only 44.2% of students did so.

Frequency of Mathematics Problems Relevant to the Community

In addition to the frequency of discussions with parents, students were asked to report on the frequency of problems presented in their mathematics classes that were directly relevant to their communities. The item, number eight, provided students with six selections from which they were to choose the one that best represented the frequency with which they saw problems relevant to their communities. Choices included 1) every day, 2) weekly, 3) more than once a month but not weekly, 4) monthly, 5) less than once a month, and 6) never. Table 9 presents the frequencies provided by student respondents.

Table 9: Frequency of problems in mathematics class relevant to community as reported by students.

Frequency of problems in mathematics class	Number of respondents	Percent of respondents
Daily	46	15.4
Weekly	55	18.4
Less than weekly	43	14.4
Monthly	28	9.4
Less than Monthly	50	16.7
Never	68	22.7
Blank	9	3.0

Nearly 15% reported seeing such problems daily in class, while another 19% responded that their classes worked such problems weekly. Almost one-fourth of respondents, however, reported that they never saw problems that were directly relevant to their own community.

Importance of Student's Mathematical Success to Parents

The student survey also inquired as to students' perceptions of the importance of their own mathematical success to their mothers and fathers. The item, number ten, asked students to select how important they felt it was to their parents that they do well in mathematics. Choices ranged from very important to not very important. Table 10 shows student responses.

Table 10: Importance of student's mathematical success to mother and father as reported by student.

Level of Importance	Importance to Father		Importance to Mother	
	N	%	N	%
Very important	182	60.9	223	74.6
Somewhat important	68	22.7	53	17.7
Not very important	9	3.0	10	3.3
Don't know	13	4.3	6	2.0
Does not apply	24	8.0	6	2.0
Blank	3	1.0	1	0.3

Nearly 61% of students reported that their success was very important to their fathers; another 23% said that it was at least somewhat important. Students also reported that their success was important to their mothers. Almost 75% of students said that it was very important to their mothers, and 18% more reported that it was somewhat important. Only 3% reported that their mathematical success was not very important to their parents.

Characteristics of Mathematical Success

Both parents and students were questioned about how they define mathematical success. Item number four on the parent survey and number eleven on the student survey presented respondents with a list of characteristics that might be associated with mathematical success. Respondents were to rank each according to how important they felt it was to being mathematically successful. Responses were in the form of a linear numeric scale and ranged from 1,

extremely unimportant, to 5, extremely important. Tables 11 and 12 present the results of the student and parent surveys.

According to the means for ranks, students considered completing the requirements for a high school diploma and being prepared for mathematics at a university to be the most important characteristics of mathematical success. Somewhat less important were taking an algebra course and being prepared for mathematics in a community college. The responses with the lowest mean rankings were working mathematics problems that are helpful to the community and working mathematics problems successfully in groups.

Parents, like students, ranked completing the requirements for a high school diploma and being prepared for a university highest. However, they tended to rank all of the other characteristics more highly than did students. For example, while students' rankings for "taking a geometry class" displayed a mean of 3.80, parents' rankings had a mean of 4.18. Also, students' rankings for "taking advanced mathematics courses" had a mean of 3.50. Parents' responses, however, demonstrated a mean of 4.09. As might be expected from this, parents also ranked taking more mathematics than is required for a high school diploma higher than did students, with a 3.99 mean ranking versus a 3.49, respectively.

Mathematics Instruction in the Local High School

Item number nine on the student survey requested students to consider various reasons that high schools teach mathematics. Students were to rank those

Table 11: Characteristics of mathematical success ranked by importance as reported by students. Scale is based on ranks 1, extremely unimportant, to 5, extremely important.

Characteristic of mathematical success	% selecting 1	% selecting 2	% selecting 3	% selecting 4	% selecting 5	Mean rank of importance
Earn A's in mathematics courses	2.3	1.7	14.4	26.8	53.8	4.29
Take an Algebra course	2.7	2.7	13.4	32.4	47.8	4.21
Take a Geometry course	6.4	6.4	22.7	28.8	34.8	3.80
Take advanced mathematics courses	7.4	12.0	29.8	23.1	26.4	3.50
Complete the requirements for a high school diploma	0.7	1.0	4.0	10.7	82.6	4.75
Take more mathematics than is required for a diploma	7.4	13.0	24.4	31.8	22.1	3.49
Be prepared for mathematics in a community college	3.0	4.3	15.7	31.4	44.1	4.11
Be prepared for mathematics in a university	2.3	2.7	8.4	23.1	62.5	4.42
Use mathematics in your future career	4.0	4.3	21.4	33.8	35.5	3.93
Learn to use mathematics in daily life	3.0	5.0	26.1	30.4	34.4	3.89
Learn to do mathematics using calculators	5.7	9.4	22.4	31.1	30.1	3.72
Learn to do mathematics using computers	5.7	9.0	22.7	31.4	30.1	3.72
Work mathematics problems that are helpful to the community	6.7	12.7	22.7	35.5	21.1	3.52
Work mathematics problems successfully in groups	6.4	10.0	27.1	30.4	24.4	3.57
Learn to use mathematics in other classes	5.7	8.7	24.1	29.4	30.8	3.72

Table 12: Characteristics of mathematical success ranked by importance as reported by parents. Scale is based on ranks of 1, extremely unimportant, to 5, extremely important.

Characteristic of mathematical success	% selecting 1	% selecting 2	% selecting 3	% selecting 4	% selecting 5	Mean rank of importance
Earn A's in mathematics courses	0.9	1.9	13.1	31.8	51.4	4.32
Take an Algebra course	0.9	2.8	9.4	27.1	58.9	4.42
Take a Geometry course	1.9	4.7	15.0	29.9	47.7	4.18
Take advanced mathematics courses	2.8	5.6	15.0	31.8	43.9	4.09
Complete the requirements for a high school diploma	0.9	1.9	1.9	3.7	90.7	4.83
Take more mathematics than is required for a diploma	1.9	5.6	17.8	40.2	33.6	3.99
Be prepared for mathematics in a community college	1.9	1.9	7.5	28.0	59.8	4.43
Be prepared for mathematics in a university	0.9	3.7	2.8	11.2	80.4	4.68
Use mathematics in your future career	1.9	1.9	14.0	36.4	44.9	4.22
Learn to use mathematics in daily life	1.9	5.6	11.2	27.1	53.3	4.25
Learn to do mathematics using calculators	3.74	5.61	24.3	32.7	32.7	3.86
Learn to do mathematics using computers	0.9	5.6	21.5	30.8	40.2	4.05
Work mathematics problems that are helpful to the community	0.9	6.5	19.6	34.6	37.4	4.02
Work mathematics problems successfully in groups	0.9	7.5	16.8	39.3	34.6	4.0
Learn to use mathematics in other classes	2.8	4.7	12.1	35.5	43.9	4.1

possible reasons in importance using a linear numeric scale of scores 1 through 5. A score of 1 represented that the student felt that this was an extremely unimportant reason for teaching mathematics in the local high school, and a score of 5 demonstrated that the student felt that this was an extremely important reason for teaching mathematics in the local high school. Table 13 provides the complete data obtained from student surveys.

For students the primary reasons for mathematical instruction in the local high schools were "to help students earn a high school diploma," "to prepare students for going to a university or four-year college," and "to give students more educational and occupational choices." The reason receiving the lowest mean rank was "to teach students to use mathematics to be good citizens."

For parents, responding in item number two to the same question as that on the student survey, the reasons receiving the highest means were also "to help students earn a high school diploma," "to prepare students for going to a university or four-year college," and "to give students more educational and occupational choices." Parents again tended to rank items with greater importance than did students. For example, students' responses demonstrated a mean of 4.08 for the purpose "to prepare students for going to a local community college. Parents, though, had a mean of 4.44 for their rankings for the same reason. Table 14 provides all parent data for this item.

Parents were also asked to provide their opinions on the appropriateness of the amount of mathematics required by the local high school. Item number one

Table 13: Importance of various reasons to teach mathematics in the local high school as reported by students.

Reason for teaching mathematics in local high school	% selecting 1	% selecting 2	% selecting 3	% selecting 4	% selecting 5	Mean rank of importance
To help students earn a high school diploma	1.3	1.3	11.7	25.8	58.5	4.41
To prepare students for going to a technical or vocational school	2.7	6.4	24.7	28.4	36.1	3.90
To prepare students for going to a local community college	1.0	3.3	21.4	33.8	38.8	4.08
To prepare students for going to a university or four-year college	1.7	1.7	7.0	18.4	69.9	4.55
To prepare students for a full time job in this community	3.7	9.0	26.8	29.8	29.1	3.73
To teach students to use mathematics in daily life	2.7	9.4	27.1	26.4	33.1	3.79
To teach students to use technology, such as calculators	4.3	9.4	27.1	27.8	29.8	3.70
To teach students to use mathematics to be good citizens	16.1	20.1	30.1	15.7	16.7	2.97
To prepare students for jobs in any communities	4.0	8.4	24.1	29.4	32.8	3.80
To give students more educational and occupational choices	1.7	3.7	13.7	27.1	52.5	4.27

Table 14: Importance of various reasons to teach mathematics in the local high school as reported by parents.

Reason for teaching mathematics in local high school	% selecting 1	% selecting 2	% selecting 3	% selecting 4	% selecting 5	Mean rank of importance
To help students earn a high school diploma	0	0.9	7.5	17.8	72.9	4.64
To prepare students for going to a technical or vocational school	0	3.7	13.1	33.6	47.7	4.28
To prepare students for going to a local community college	0.9	0.9	11.2	26.2	59.8	4.44
To prepare students for going to a university or four-year college	0.9	0.9	3.7	15.0	78.6	4.71
To prepare students for a full time job in this community	1.9	7.5	26.2	28.0	35.5	3.89
To teach students to use mathematics in daily life	0	10.3	13.1	29.0	46.7	4.13
To teach students to use technology, such as calculators	1.9	6.5	24.3	29.9	36.4	3.93
To teach students to use mathematics to be good citizens	10.3	17.8	29.9	15.9	25.2	3.28
To prepare students for jobs in any communities	0	5.6	18.7	29.9	44.9	4.15
To give students more educational and occupational choices	1.9	0	11.2	14.0	72.0	4.56

allowed parents to choose one of three statements that best represented their opinion on the amount of mathematics required by the local high school, namely that the amount was too much, an appropriate amount, or too little to require. Table 15 demonstrates parent data for this item.

More than 80% responded that the amount of mathematics required is appropriate at their local high school. About 9% believe that too much mathematics is required, and 6.5% believe too little mathematics is required.

Aspirations and Expectations of Students

Students were asked several questions relating to their occupational and educational aspirations and expectations. Information sought included the mathematics courses taken by students and the reasons for their selection, future career plans, and the highest level of education expected by students. Item

Table 15: Parents' opinions on the appropriateness of amount of mathematics required by school

Appropriateness of mathematics required by local high school for graduation	Parent respondents	
	N	%
Too much mathematics is required	10	9.4
Appropriate amount required	88	82.2
Too little mathematics is required	7	6.5
Unreported	2	1.9

number five collected information on the mathematics courses taken by students. A list of courses was created for each high school based on the offerings available at that school. Students were to choose from three responses for each courses shown: 1) have taken, 2) will take, or 3) have not and will not take. Using the data provided by students on the number of courses already taken and the number expected to be taken, a sum of total expected mathematics credits was calculated for each respondent. Table 16 provides the number and percentage of respondents expected various totals of mathematics credits.

Nearly three-fourths of respondents expect to complete three to five credits by high school graduation. Another 16% expect six to seven credits. The three respondents with a total of zero expected credits left the item blank.

Table 16: Number of high school mathematics credits expected by graduation as reported by students.

Number of Credits Expected	Number of Respondents	Percent of Respondents	Number of Credits Expected	Number of Respondents	Percent of Respondents
0	3	1.0	6	35	11.7
1	2	0.7	7	13	4.3
2	13	4.3	8	9	3.0
3	76	25.4	9	0	0.0
4	80	26.8	10	1	0.3
5	67	22.4			

In item number six, students were provided a number of possible reasons for taking the mathematics courses that they had selected. Students were to check any and all reasons that had influenced their choices of classes. Table 17 provides the number of respondents who placed a check next to each reason.

Over 80% of students indicated that graduation requirements at their high schools influenced their course selections. Preparing for college mathematics was the influence chosen next most often, with about half of students indicating that this was an influence on their course selection. Preparing for a job after high school was indicated as an influence by 33.8% of students, and about one fourth of students reported that parents' encouragement or taking courses at the appropriate level were influences on course selection. Thirteen percent reported that they did not feel that they have a choice in course selection.

Items three and four on the student survey asked students to name the occupation they would most like to have and the occupation that they expect to have, respectively. Students filled in the blank with their choices, although several actually wrote out brief commentaries. Although the commentaries were not usable in the data analysis, some of them are discussed in Chapter VI. The usable responses are included in Table 18, which demonstrates the occupational aspirations and expectations of students.

Three categories were created for the student responses, including jobs requiring a college degree, jobs requiring some education beyond high school, and jobs that require minimal education. Just over 54% of respondents had

Table 17: Reasons for course selection as reported by students.

Reason for selecting courses	Number of Respondents	Percent of Respondents
Required courses for graduation	247	82.6
Nothing else to take	5	1.7
Required courses for program of study	71	23.7
Enjoy mathematics courses	64	21.4
Preparation for college mathematics	153	51.2
Parents' encouragement	72	24.1
Preparation for a job after high school	101	33.8
Taking courses at my level	76	25.4
Don't really have a choice	39	13.0
Don't know	13	4.3

Table 18: Occupational aspirations and expectations of students.

Educational requirement of occupation	Aspirations		Expectations	
	Number of Respondents	Percent of Respondents	Number of Respondents	Percent of Respondents
I. Jobs that require a college degree	162	54.2	147	49.2
II. Jobs that require a high school diploma and some college or certificate	66	22.1	72	24.1
III. Jobs that require no diploma or additional schooling	21	7.0	20	6.7
Unreported	12	4.0	17	5.7
Don't know	13	4.0	23	7.7
Other (unusable responses)	25	8.0	20	6.7

aspirations for a career that required a college degree, and 7.0% aspired to jobs requiring less than a high school diploma. As for student expectations, there was a slight decrease in the percent of students expecting a job that required a college degree versus the percent that aspired to a college degree. Slightly more than 49% reported that they expected to have a job requiring a college degree compared with the 54.2% who aspired to jobs requiring a college degree.

Student reports of occupational aspirations and expectations can also be reviewed by gender. Table 19 breaks down the student responses into aspirations for male and female students and expectations for male and female students. Table 16 demonstrates that the percentage of female students aspiring to or expecting jobs that require a college degree is higher than that of males. Of females, 61.8% aspired to such jobs while 44% of males did so. Also, 59% of females expected to have those jobs in the future, while just over 32% of males expected them.

Item number twelve asked students to report the highest level of education they expected to attain. Students were to select the one response that best represented the level of education that they expected. Responses included 1) may not finish high school, 2) should graduate high school, 3) should get a certificate from a vocational, trade, or business school, 4) should get an Associate's Degree or two-year degree from a community college, 5) should get a Bachelor's Degree or a four-year degree from a college or university, 6) should get a graduate or professional degree, and 7) don't know. These results are provided in Table 20.

Table 19: Occupational aspirations and expectations of students by gender.

Occupations reported by students	Aspirations				Expectations			
	Male		Female		Male		Female	
	N	%	N	%	N	%	N	%
I. Jobs that require a college degree	44	43.6	118	61.8	35	32.4	112	58.6
II. Jobs that require a high school diploma and some college or certificate	20	19.8	46	24.2	22	20.4	50	26.2
III. Jobs that require no diploma or additional schooling	17	16.8	4	2.1	16	14.8	4	2.1
Unreported	4	3.9	8	4.2	6	5.6	11	5.8
Don't know	8	7.9	5	2.6	15	13.9	8	4.2
Other (unusable responses)	15	14.9	10	5.2	14	13.0	6	3.1

Table 20: Highest level of student education expected by students as reported by students.

Highest level of education expected by students	Number of respondents	Percent of respondents
May not finish high school	2	0.7
Should graduate high school	33	11.0
Should get a certificate from a vocational, trade, or business school	32	10.7
Should get an Associate's Degree or two-year degree from a community college	27	9.0
Should get a Bachelor's Degree or a four-year degree from a college or university	104	34.8
Should get a graduate or professional degree	83	27.8
Don't know	16	5.4
Blank	2	0.7

Although 49.2% of students had indicated that they expected jobs that required a college degree, more than 62% reported actually expecting to complete at least a bachelor's degree after high school. Less than one percent may not finish high school, and 11% anticipate going no further than high school.

Although Table 17 demonstrated the reasons for students' choices of mathematics courses as indicated by item number six, the data collected allowed for students' course choices to be compared to their educational and occupational expectations. Thus Tables 21 through 24 demonstrate the relationships between students' choices in mathematics choices and the other characteristics discovered by the survey.

The mean number of mathematics courses expected by students increased with the educational requirements of students' expected occupation. Table 21 shows the average number of mathematics credits expected by students according to the educational requirements of their expected occupations.

Students who expected to have a job that required a college degree expected to complete a mean of 4.7 mathematics courses by high school graduation. Students who expected jobs that required a high school diploma and some college or certificate expected to have a mean of 4.d credits in mathematics and those expecting jobs that do not require a high school diploma or additional schooling anticipated completing 3.5 mathematics courses by graduation.

Similarly, the mean number of mathematics courses expected by students increased with the educational requirements of occupations aspired to by students but not necessarily expected. Table 22 demonstrates the mean number of

Table 21: Mean number of mathematics credits expected by students based on educational requirements of occupational expectations reported by students.

Occupational expectation reported by students	Mean number of mathematics credits expected by students
I. Jobs that require a college degree	4.7
II. Jobs that require a high school diploma and some college or certificate	4.1
III. Jobs that require no diploma or additional schooling	3.5
Items left blank, marked "don't know" or completed in a manner that was not usable	3.8

Table 22: Mean number of mathematics credits expected by students based on occupational aspirations reported by students.

Occupational aspiration reported by students	Mean number of mathematics credits expected by students
I. Jobs that require a college degree	4.7
II. Jobs that require a high school diploma and some college or certificate	3.8
III. Jobs that require no diploma or additional schooling	3.3
Items left blank, marked "don't know" or completed in a manner that was not usable	3.8

Table 23: Mean number of mathematics credits expected by students based on highest level of education expected by students.

Level of education expected	Mean number of mathematics credits expected by students
May not finish high school	4.0
Should graduate high school	2.9
Should get a certificate from a vocational, trade, or business school	3.6
Should get an Associate's Degree or two-year degree from a community college	4.5
Should get a Bachelor's Degree or a four-year degree from a college or university	4.6
Should get a graduate or professional degree	4.6
Don't know	3.7
Blank	4.0

Table 24: Mean number of mathematics credits expected by students based on highest level of education completed by parents.

Highest level of education completed by father	Mean number of mathematics credits expected by student	Highest level of education completed by mother	Mean number of mathematics credits expected by student
Less than high school	3.8	Less than high school	3.9
High school diploma	4.2	High school diploma	4.1
Certificate from a trade or vocational school	4.8	Certificate from a trade or vocational school	4.5
Two-year degree	4.4	Two-year degree	4.6
Four-year degree	4.4	Four-year degree	5.0
Graduate/professional degree	4.7	Graduate/professional degree	4.3
Don't know	4.1	Don't know	4.0

mathematics courses expected by students according to the educational requirements of the occupations to which they aspire.

Again, the mean number of mathematics credits expected by students aspiring to jobs that require a college degree is 4.7. The mean drops to 3.8 for students aspiring to jobs that require a high school diploma and some additional schooling. The mean for jobs that require less than a high school diploma, the mean is 3.3.

Considering students' choices of mathematics courses based on their expected educational levels reveals that students who expect to complete higher levels of education also expect to complete more mathematics courses by the time of their graduation. Table 23 demonstrates the results of finding the mean number of mathematics credits expected by students based upon their educational expectations.

Students expecting to finish high school but no additional education expect to complete 2.9 mathematics credits by graduation, while those expecting to complete vocational training after high school expect to complete 3.6 credits. A mean of 4.5 credits are expected by students who anticipate receiving a two-year degree, and for students expecting to complete a four-year degree or more, the mean nudges up to 4.6.

The mean number of mathematics courses expected by students can also be reviewed in light of the level of education completed by parents, as in Table 24. The mean number of mathematics credits expected by students is 3.8 when

the father has completed less than a high school diploma, 4.2 when he has the high school diploma or equivalent. The mean number increases to 4.8, however, for sons and daughters of fathers with certificates from trade or vocational schools. Fathers with two or four-year degrees have sons and daughters expecting a mean of 4.4 mathematics credits by high school graduation, and those with graduate or professional degrees have sons and daughters expecting a mean of 4.7 mathematics credits.

Similar numbers are observed for sons and daughters of mothers with a high school diploma or less, but the mean increases along with mother's educational level for the next three categories. Students whose mother has a certificate from a trade or vocational school expect a mean of 4.5 mathematics courses, while those with a two-year degree anticipate 4.6 credits. The highest mean, 5.0, was observed for sons and daughters whose mother had a four-year degree

Parents, when asked to report in item number five on the level of education they expected their children to attain, reported results that were somewhat more optimistic than those reported by students. Table 25 demonstrates parent responses to item number five.

Three-fourths of parents expect their sons or daughters to complete a four-year degree or more. About 20% expect their sons or daughters to obtain a two-year degree or certificate from a vocational, trade, or business school. These percentages are slightly higher than those provided by students in reporting their own educational expectations. For example, while 27.8% of students expect to

Table 25: Highest level of student education expected by parents as reported by parents.

Highest level of education expected by students	Number of respondents	Percent of respondents
Should graduate high school	2	2.9
Should get a certificate from a vocational, trade, or business school	9	8.3
Should get an Associate's Degree or two-year degree from a community college	13	12.0
Should get a Bachelor's Degree or a four-year degree from a college or university	38	35.2
Should get a graduate or professional degree	43	39.8
Don't know	1	0.9
Unreported	1	0.9

receive a graduate or professional degree, 39.8% of parents expect their sons or daughters to receive the graduate or professional degree.

Parents' Occupational Use of Mathematics

In item number 6, parents were asked to report on the mathematics they use in their careers. A series of statements referring to mathematics use was provided, and respondents were to place a check next to any and all that adequately describe their use of mathematics on the job. Nearly 48% report that mathematics is very important to their jobs, while only 4.7% report that they do not use mathematics at all in their careers. Table 26 demonstrates how parents characterize their own use of mathematics on the job. More than 65% report using basic mathematics every day, and an additional 16.8% use basic mathematics sometimes but not every day. Less than 6% use geometry every day, but 16.8% report using geometry sometimes. Nearly 46% of parents report regularly using a calculator or adding machine or using mathematical thinking on the job. Measuring weights, distances, and temperatures is done by 23.4% of parent respondents.

Summary

The data reported in this chapter indicates that students in these four rural areas anticipate completing a higher level of education than that attained by their parents. They also aspire to or expect occupations that require a higher level of education. Students and parents have some similar values in defining

Table 26: Parents report of the frequency and kinds of mathematics used in their careers.

Statement about mathematics use	Percent of respondents marking statement "true"
I use basic mathematics every day.	65.4
I sometimes use basic mathematics but not every day.	16.8
I use geometry every day.	5.6
I sometimes use geometry but not every day.	16.8
I use a calculator or adding machine regularly.	45.8
My job requires me to measure weights, distances, or temperatures.	23.4
I often use mathematical thinking on the job to solve problems.	45.8
I often use advanced mathematics at work.	18.7
My job does not require me to use mathematics at all.	4.7
Mathematics is very important to my job.	47.7

mathematical success and in considering the reasons for teaching mathematics at the local high school. However, parents tend to be more optimistic in their expectations and to value work related mathematical skills, such as using calculators or solving mathematics problems in groups, more than students.

CHAPTER V

Findings and Recommendations

Introduction

This study investigated the significance that parents and high school students in four rural Appalachian communities attach to mathematics and to mathematics education in their local high schools. The study also explored how parents' perceptions of mathematics and mathematics education related to students' perspective of mathematics and mathematics education and to students' choices in high school mathematics courses in the four communities under study. Questionnaire surveys were used to collect data, with a response rate of 12% for student surveys and 10.4% for parent surveys. This response rate is low, so the reader is advised that all findings and conclusions presented and discussed in this chapter are based on a small number of respondents.

Findings from the Literature

The literature review presented in Chapter II provided several findings concerning rural mathematics education:

1. Socioeconomic factors and the visible jobs in rural areas affect the occupational and educational aspirations and expectations of rural students.
2. Parent influences may mitigate the effects of socioeconomic factors on the occupational and educational aspirations of rural students.
3. Fewer high school graduates in rural areas continue on to post-secondary education.

4. Small schools and more focused curricula often associated with smaller, rural schools may not be a hindrance to future educational and occupational pursuits.

5. Mathematics achievement in rural areas does not appear to be dramatically different from that in nonrural areas.

The literature review supported the idea of continued examinations of the rural context, particularly in how the context affects various aspects of education. Researchers are encouraged to evaluate rural areas with respect for rural definitions of success and for rural values, not in such a way as to seek to make rural areas function more like urban ones.

Findings from the Study

A set of eight questions guided the research study. Each question and its associated findings are discussed below.

Question one investigated the use of mathematics in the occupations of parents. Parents completed a free-response item to indicate their profession and a multiple-response item to demonstrate the mathematics used in that profession. More than 45% reported holding a job that required some training or college after high school but not a four-year degree, and of the nearly ten percent holding jobs that do require a four-year degree, most were teachers. Other careers listed often included nursing, manufacturing work, truck driving, and ownership of a small business.

Some 65% of parents report using basic mathematics every day, and an additional 16.8% use basic mathematics sometimes but not every day.

Mathematical skills used often by parents include using calculators or adding machines, using mathematical thinking, and measuring. Nearly 48% of parents reported that mathematics is very important to their jobs.

Nearly 19% reported using advanced mathematics in their jobs. Jobs associated with these parents included a science teacher, an engineer, a business student, and a parent who works in construction. Three business owners also indicated that they used some advanced mathematics in their jobs.

Only 5.6% of parents responded that they used geometry every day, but another 16.8% indicated using geometry at least sometimes. Among those using geometry frequently were a science teacher, an engineer, a truck driver, a quality control manager, and a maintenance worker.

Question two sought to describe how parents and students characterized mathematical success in their communities. To respond, parents and students completed an item using a linear numeric scale; for each possible characteristic of mathematical success, respondents ranked them with a score of 1, extremely unimportant, to 5, extremely important. Parents and students agreed that completing the requirements for a high school diploma and being prepared for mathematics courses in a university or four-year college were the two most important characteristics of mathematical success. There was also strong support for earning A's in mathematics courses and taking an Algebra course. Taking a geometry course was somewhat less important to both parents and students, as was completing more mathematics than is required for a diploma. Parents tended to rank learning to do mathematics with computers and calculators more highly

than did students, perhaps because, as indicated by question one, parents use these items frequently in their work. Similarly, parents scored working mathematics problems successfully in groups as more important than did students. Again it is likely that they have developed this perception in their careers. Both parents and students scored working mathematics problems that are helpful to the community lower than most of the other characteristics.

Question three considered the purposes behind teaching mathematics in local high schools as reported by parents and students. For this item, parents and students again completed rankings on a linear numeric scale with scores of 1 to 5. Parents and students agreed that the primary reasons for mathematics instruction were to help students receive a high school diploma and to prepare students for study in a university or four-year college. Since about half of students expect to hold jobs that require a four-year degree, it is not surprising that they believe their preparation for college study is an important purpose of teaching high school mathematics. However, about one-fourth of students expect to hold jobs requiring a two-year degree or some sort of vocational certification and nearly twenty percent of students expect to complete a two year-degree or vocational training. Still these two purposes received lower mean rankings than did preparing students for the pursuit of four-year degrees.

Question four addressed the frequency of discussions about mathematics classes between parents and children. For this item, parents and students selected one option among five that best represented the frequency of discussions. A total of 74% of parents reported having discussions less often than once per week, and

half of those selected never. Only 11.5% indicated that they had discussions with their children more than once per week. Students, though, reported much more frequent discussions. More than half of student respondents indicated having discussions more often than once per week. One third reported discussions that were less frequent than once per week.

Obviously parents and students have different perceptions on what constitutes a discussion about mathematics class. Perhaps students consider any mention of mathematics class, including encouragement to complete mathematics homework, a discussion while parents view a more in-depth talk as a discussion.

Question number five investigates which mathematics courses rural high school students are taking and what reasons influence course selections. About three-fourths of student respondents expected to complete three to five mathematics courses by the time of their high school graduation. Another sixteen percent expected to complete six to seven courses by graduation.

When provided a particular list of reasons from which to select influences on their choices, students indicated that their preferences for mathematics courses are guided by their intent to earn a high school diploma and their preparation for attending college. Somewhat less important were preparation for a job after high school, parents' encouragement, and taking courses at an appropriate level. Nearly thirteen percent of students reported that they did not feel that they had a choice in their mathematics curriculum.

Question number six addressed how students' choices of courses and perspectives on mathematics education related to their educational expectations. As might be expected, the higher the student's educational expectation, the larger the mean number of mathematics credits expected by the student.

For students expecting to graduate high school but go no further the mean number of mathematics credits was 2.9. Students expecting to obtain a certificate from a vocational, trade, or business school expect to complete a mean of 3.6 courses by graduation, while those expecting a two-year degree, four-year degree, or graduate degree anticipate completing a mean of 4.5, 4.6, and 4.6 credits, respectively.

Question number seven considered how students' choices of mathematics courses related to their occupational aspirations and expectations. Considering the number of courses expected by students based upon their occupational expectations reveals that students who expect to hold a job that requires a higher level of education expect to take more mathematics courses by the time of their high school graduation. Students expecting to hold a job that requires a four-year college degree will complete a mean of 4.7 mathematics courses. Those expecting a job that requires a high school diploma and some additional schooling or training but not a four-year degree expect to complete a mean of 4.1 mathematics courses, and those expecting jobs requiring less than a high school diploma look to a total of 3.5 courses by graduation.

Looking at occupational aspirations, a similar pattern is observed. For students aspiring to jobs that require a four-year degree, the mean number of

mathematics credits expected is 4.7, but for those aspiring to a job with less education required, the mean is less. For those aspiring to jobs requiring a high school diploma and some additional schooling, the mean is 3.8; for jobs requiring less than a high school diploma, the mean is 3.3.

Question number eight discovered how students' choices of mathematics courses related to his or her parents' educational status, which is generally recognized as an excellent indicator of socioeconomic status as well. The mean number of mathematics credits expected by students is 3.8 when the father has completed less than a high school diploma, 4.2 when he has the high school diploma or equivalent. The mean number increases to 4.8, however, for sons and daughters of fathers with certificates from trade or vocational schools. Fathers with two or four-year degrees have sons and daughters expecting a mean of 4.4 mathematics credits by high school graduation, and those with graduate or professional degrees have sons and daughters expecting a mean of 4.7 mathematics credits.

Similar numbers are observed for sons and daughters of mothers with a high school diploma or less, but the mean increases along with mother's educational level for the next three categories. Students whose mother has a certificate from a trade or vocational school expect a mean of 4.5 mathematics courses, while those with a two-year degree anticipate 4.6 credits. The highest mean, 5.0, was observed for sons and daughters whose mother had a four-year degree. For those with a graduate or professional degree, the mean dropped to

4.3. There does appear to be a relationship between the level of a parent's education and the number of courses expected by a student.

Recommendations

The findings discussed in Chapter V provide a first look at mathematics education in these rural communities, but much is left to be done. The recommendations that can be offered at this point include those for the schools involved and for future research.

For schools

1. Students in the four participating schools aspire to and expect jobs requiring a higher level of education than that of their parents. Students also expect to complete a higher level of education that did their parents. Thus, schools may need to ensure that their guidance programs are strong as parents may not have the experience with college or occupational preparation to help their students attain their goals.

2. Although parents do not demonstrate the educational levels aspired to or expected by their children, they do have high expectations of their sons and daughters. Educating parents on the requirements for careers in which their students are interested and on the requirements of college attendance may provide parents with the knowledge to encourage and support their sons and daughters.

3. Male students demonstrated lower aspirations and expectations than did female students, whose predominant occupational expectations of nursing and teaching require additional schooling beyond high school. Schools

may wish to encourage male students to explore more varied career options through educational or mentoring opportunities.

4. Parents and students valued geometry less as an element of mathematical success in spite of its historical significance in mathematics. Perhaps the four participating schools should look carefully at the geometry courses offered in their schools to provide more opportunities for connections of geometry to other subjects and for the inclusion of more real-world applications of geometry.

5. Students did not rank characteristics involving the real-world use of mathematics as very important to mathematical success. Schools may wish to include more real-world applications in their curriculum, such as mathematical problems relevant to being a consumer or informed citizen.

For research

1. Parents valued education and mathematical achievement for their sons and daughters even when their own educational attainment was minimal. Researchers may wish to address how to assist parents with lower educational levels to support their own sons and daughters in accomplishing their own educational and occupational goals. The questions addressed may include how effective informational programs are and what needs parents have in understanding their sons' and daughters' needs in post-secondary education.

2. Instruction and guidance in the four participating schools may be addressed to consider how these aspects of the schools' programs interplay with characteristics of the students and their parents. Are these schools actively

assessing the needs of their constituencies? How do these schools determine their instructional needs and goals in relation to their communities?

3. Students set high aspirations and expectations for themselves. Are students in these areas accomplishing the occupational and educational goals that they have set for themselves? Why or why not?

4. Parents report using mathematics regularly in their jobs. Are these schools adequately preparing students for the types of jobs available in their communities?

5. Parents and students generally agree on the reasons that mathematics is taught in the local high schools. Would these reasons agree with those suggested by administrator? By teachers? By other members of the community? Do these schools do an adequate job of informing parents and students of the purposes of teaching mathematics in the local high school and of the importance of mathematics in future plans?

CHAPTER VI

Thoughts on Conducting Rural Educational Research

Purpose

The reader is reminded that this chapter deviates from the data collected for the study and presents instead the researcher's experiences in conducting this rural study. The researcher also presents some suggestions and thoughts for rural educational research. It is hoped that these thoughts may be of some use to other researchers in planning similar studies.

Introduction

In the twentieth century, rural America did not remain at the forefront of concern in planning educational policy. Suburban and urban schools generally held the spotlight of educational research, and rural schools were developed to appear to be more like their nonrural counterparts. By the latter decades of the twentieth century, however, a number of researchers returned to the rural question with new vigor and focus. Several developed research agendas that were intended to guide researchers or organizations in the pursuit of understanding of rural areas (Carter, 1999; Dobson & Dobson, 1987; Harmon, Henderson, & Royster, 2003; Helge, 1986). These agendas include poignant questions that will no doubt assist in developing the understanding of rural context for future educational research.

Even as rural researchers call for attention to be paid to rural areas, they are aware of the difficulties in attracting that attention. Universities, often centers for such research, are according to Howley tainted by a "cosmopolitan, modernizing mission . . . perhaps pursued with the highest purpose the more the

university's territory is understood to be a parochial backwater" (1997b, ¶ 10). On the other hand, urban universities are not necessarily any better prepared for the work since, although their faculty may provide insight into rural issues, the faculty are "not usually here or for very long" (1997b, ¶ 11). By "here" Howley refers to the rural environment, indicting many researchers for maintaining their work in rural areas at a comfortable distance. A more intimate knowledge of rural areas that may only arise from living and working in rural areas may be necessary for pursuing meaningful rural research. Rural residents would likely agree. As one editor wrote about educational policy,

> We don't particularly relish being told in one breath that we are the salt of the earth, that on us and our labors rest the foundations of the economic structure of the business and politics of the nation, and in the next breath that we are isolated, lonely, groping in dark ways, and need a commission of professors to inquire into our malady" (*Lo! the poor country farmer*, 1908, p. ?)

On the other hand, policymakers bemoan the fact that it is difficult to encourage researchers to focus on rural issues or that when they do, it is to analyze their perceived deficiencies (Sherwood, 2001).

In light of the new calls for attention to rural research, then, it is important to view the rural context respectfully and without the narrow perceptions dictated by a metropolitan mindset. However just as it is important to understand the rural context for *interpreting* educational research, it is important to understand how the rural context affects *designing* educational research. This involves the consideration of some very basic aspects of research, such as communication, trust, and statistical analysis.

Communication

As with any study, communication with the participating schools was necessary for its success. Consequently, communication with participating schools and respondents was not to be taken for granted. Nor, surprisingly, was it to take the same forms as communication on the university campus where I worked.

For example during the writing of the proposal of the study, I contacted each principal by email to introduce the topic of my study and to request a meeting to discuss it. None of the principals responded by email. At a later point, I faxed each principal an additional outline of the plan for the study for their review before my next meeting with each of them. At that next meeting, only one principal appeared aware of the contents of the fax. Of course, a great deal of communication is completed in contemporary society via emails, faxes, or other indirect means. I did not see that these means were successful in working with the four rural schools under study. However, with face to face visits I had great success. The in person meetings were generally warm and rather informal. Principals asked a number of questions and presented honest interest in the study.

The questions asked by the principals and superintendents of the schools were telling, in a way, of the rural circumstance. In one district, the superintendent expressed serious concerns about how questions relative to family relationships and family structures might be asked. In general, when thinking of a rural area, the image of a traditional family with father, mother, and children springs to mind. Unfortunately, that is not the case in the four communities under

study. Instead, divorce rates and teenage pregnancies have created a high incidence of single parent families. Also high is the number of families in which grandparents or other non-parent relatives care for children. Recent arrests related to the production, distribution, and use of methamphetamines has left many families in fragments and children in foster care. Consequently, questions that asked about fathers or mothers needed to have options such as "Does not apply" or "Don't know." Interestingly, some students used the surveys to comment on these situations. When asked about the occupation of her parents, one student wrote in "Retired – I was adopted by my grandparents." Another student identified his father's occupation as an "alcoholic." Still another described his father's occupation as a "full time asshole." Eleven students identified parents who were disabled, and a few explained that the parent had been a miner or iron worker. Because of the danger involved in certain jobs typical of rural areas, the number of disabled adults can be high.

In addition, the number of adults without a high level of schooling may be high. Comments made by staff members of two of the superintendent's offices suggested that some adults in the areas, including parents targeted for this study, may not be capable of reading or responding to a survey. In fact, data presented by the Appalachian Regional Commission indicates that in 1990, just 64% of adults in Appalachian Tennessee had high school diplomas (Appalachian Regional Commission, DATE). Hence, the survey had to be worded simply and carefully to allow respondents with less than a high school education the opportunity to read it. It was hoped that the son or daughter, a current high school

student, could assist in the reading and completion of the survey. Of course, telephone surveys would have eliminated the problem of reading the surveys, but this brought two additional problems with it. First, according to educators in the communities, not all families had telephones. Thus using a telephone survey would have possibly eliminated families of certain socioeconomic backgrounds from participating in the study. Second, one superintendent held serious concerns about sharing private information, such as addresses or telephone numbers, of students or their parents for the study. For reasons similar to those above, email surveys were also unsatisfactory methods of collecting data.e Email or online surveys did not protect against excluding those of lower socioeconomic backgrounds or those unable to read the survey.

Another aspect of the rural community that was to be considered was in the numbering of the surveys sent to parents and students. Interestingly, there were enough surveys distributed at two of the schools that there were surveys marked with the identifying number of "666." Both of the surveys were returned, and both had the identifying number scratched out with a black marker. Of course, rural areas in the Appalachians are generally believed to be quite fundamental religiously, so the inclusion of the number may have had a religious significance to them.

Communicating deadlines to participating teachers and principals was a more difficult endeavor than expected. This was not simply a lack of respect for deadlines on the part of the participants. Rather, participants saw the deadlines as guidelines of when to have surveys ready for pick up or did not provide me

adequate information of their schedules so that appropriate deadlines could be made. For instance, in one school the morning chosen as a pick-up day for the first distribution of surveys was the same day on which students were leaving campus for a field trip to a theatrical performance. Since students had been informed to show up empty-handed and ready to load onto a bus, they did. Needless to say, student returns on that day were poor. Also, one afternoon designated as a pick-up day for the second batch of surveys found me standing outside of a locked and empty school building after driving for over an hour. A power failure had forced the school to close earlier in the day, but no message was delivered to reschedule my pick-up of surveys.

A more unpredictable aspect of communicating deadlines involved the weather. Snow interrupted the second distribution and pick-up of surveys by forcing schools to close for several days over a course of three weeks. With the interruption, students were understandably forgetful in bringing back their completed surveys.

Thus communication played a major role in the successful planning and implementation of the study. Direct, in-person discussions were successful with superintendents, principals, and teachers, while indirect methods, such as faxes or emails, were quite unsuccessful. Communicating and maintaining deadlines or appointments was difficult since communication was quite informal and weather was a major factor.

Trust

The stereotypical Appalachian retains clannish connections to his kin and withholds trust in others. Of course, this stereotype is too simplistic to be true, but trust remained a crucial component of the study.

Within hours after delivering the first batch of surveys to one school, I received a message from a teacher who insisted on knowing more about the study than was presented on the information sheet included with the bundle of surveys (See Appendix C). I had two concerns with this message. One was that I feared that the principal had not provided information to teachers about the impending study. The other was that I realized that teachers might not trust the intention of the study. In subsequent conversations with teachers at the schools, I learned that several teachers had actually encouraged their students *not* to participate in the study. Some seemed to want to protect their students. One explained that her students were often asked to complete surveys for commercial purposes, such as product research. She preferred not to involve her students in that type of activity, so she hesitated to engage in the study. In addition, explained one teacher, students were used to completing surveys for commercial purposes and expected to receive some payment or coupon or free item for doing so. Since there was no place on the survey for students to provide a mailing address to receive the payment or item, they were unsure that they wished to participate.

Early in the planning of the study while working with one superintendent to gain permission to survey students in his district, I met with one unexpected problem that had originated as a betrayal of trust. During a lengthy meeting in

which we reviewed each item on the surveys, I worried that the superintendent simply did not want to participate in spite of his earlier agreement to do so. He finally explained to me his true concern about the study. Apparently, many years ago while he worked in another school district, he was asked by a researcher for access to the schools in his district for a year-long study. Eventually that researcher published a book in which several different communities were compared and contrasted based on the researcher's experiences living for a year in each location. The rural school district where the superintendent worked was painted as a racist community that was much less than friendly to outsiders. His worry, he explained, was the light in which his community would be cast in this study as well. By sharing my own perspective of the need for respecting rural contexts, I was able to demonstrate for this superintendent that I had no intention of misrepresenting his community. Furthermore, by revisiting the survey items, I showed that the particular questions included did not provide me any information on students' or parents' experiences or beliefs on anything beyond their mathematics education or occupations. Still it is disheartening to reflect on the lack of trust represented by this superintendent in rural educational research itself.

Another staff member at a superintendent's office demonstrated distrust in the usefulness of any rural educational research study. She listened intently as I shared the idea behind my study, nodding as I concluded that perhaps a better understanding of rural areas could be used to improve rural education. Then she remarked, "But right now we still have to do whatever the state says. We still

have to be evaluated just like every other school in the state. We're different, but who's going to look at us differently?"

Obviously the teachers demonstrated a distrust of what was to be done with survey data, the administrators a distrust of how the results would be presented or used. Parents, too, seemed to have some distrust of the study and of their own local schools.

In the analysis of data, only completed student surveys that included a signed parent permission form were used. However, four parent permission forms came back without signatures but with written notes. One parent wrote that the school already took up enough of her child's time, so she did not want him or her to participate. Others simply made a note that they did not want their children to participate. One completed parent survey included a written note as well. The writer noted that she felt that the mathematics classes at her school favored some students over others. Of course, this notion is found among parents in communities of all types. However, the same parent had indicated that she was employed as a teacher in the school district. Her note seemed to show her distrust of the effectiveness of speaking out in the school district about the problem that she perceived.

Students displayed a sort of distrust in their own futures with some of their responses to the surveys. That distrust was evident in the negative responses given by some when asked for their occupational aspirations and expectations. For instance, one student who aspired to be a teacher expected a job "that makes no money." Another student aspiring to be an electrician, expected to take

"whatever I can get." Still others reported expecting to flip hamburgers, pump gas, fix things, or do hard labor. All of these students were males, which may not necessarily be a surprise. The negativity displayed, though, may be an indication that the male students in these rural areas, many of whom are raised in single parent homes or by relatives other than their parents, do not see positive occupational role models. Furthermore, all but one of the students whose responses are listed above aspire to an educational level no greater than a high school diploma. Obviously there is a group of students with serious needs in terms of guidance and motivation included among these respondents. Perhaps they are even more heavily represented among those who did not respond.

Trust was an important part of my relationship as a researcher with the communities, both in trusting their ways of doing things and in their allowing me access. The issues of trust within the community, though, are just as important to the underlying issues of mathematics education but are far beyond my control.

Analyzing Statistics

The literature already demonstrates that the field of rural educational research fails to use a single definition of what it means to be rural. Consequently, little can be inferred by comparing studies. Furthermore, since one rural area of the country is not guaranteed to be very similar to another, even the creation of a single definition of what it is to be rural may prove fruitless.

For instance, in this study, I began with four high schools that bore rural classifications as provided by the United States Department of Education. However, as all four schools were in rural, Appalachian, east Tennessee, it makes

little sense to compare the results to rural areas of the Midwest or Mississippi Delta. Those areas did not have strong extractive industries for many decades, nor do they possess the same difficulties created by a Mountainous terrain. Furthermore, although the heritage of the Appalachian areas of east Tennessee is largely Scottish and Irish, the populations of the Midwest or Mississippi Delta would not necessarily be of the same descent.

Still some researchers use statistics to "level the playing field," in a way, but this may also be a poor choice of methodology. Comparing means of various characteristics or of student performance may allow for a simple comparison of such factors, but it is exactly that – simple. Instead, to truly approach the in-depth understanding of the rural context suggested by Howley and others, means must be provided within a thorough description of that context. In this way, a more accurate interpretation may be made, and, perhaps, the problems associated with defining rural may be avoided. Thorough descriptions of the communities, including sociological, economical, and geographical descriptions, would provide information necessary to determine the application of prior studies in new communities.

Even inferential testing may be inappropriate in many rural studies. Oakes suggests that such testing, especially of significance testing, is overused to the point of abuse in the social sciences, including education. He suggests that significance testing is a prime cause of the "design of low-power studies" (Oakes, 1986). Selvin agrees with this notion and adds that the conditions of an experimental study are generally not met in the sociological research. In

particular, he describes a hypothetical example in which rural residents in a random sample are discovered to have lower levels of political interest than do urban residents. There are not conditions under which it makes sense to subject the results to a test of statistical significance (Selvin, 1957). Instead, the differences that exist simply *are*.

Conclusion

Implementing a rural research agenda calls for a special understanding of its context since effective, meaningful research requires more than a sterile look at numbers. At this point, deeper investigations that link what is known in sociology, history, and literature to what is needed in education are necessary. Such investigations will rely on researchers' honesty, communication, motivation, and respect. Researchers will have to navigate through customs, beliefs, and attitudes that may be quite different from his or her own, but these very differences lie at the heart of what is needed in the field of rural educational research.

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APPENDIX

Appendix A
Student Questionnaire

Date

Dear Parent:

I am a graduate student at The University of Tennessee and would like to know about your child's thoughts on mathematics in his or her high school and life. Your child's opinions are important to my research and may help schools such as yours to understand and use his or her ideas on mathematics in the future.

There is no risk to your son or daughter in participating. **The identity of your child will remain confidential, and no one in your school district or community will see your child's responses.** There is no cost to your child to participate, and the survey can be completed very quickly. I will combine your child's responses with those of many other students from your community for analysis. If you agree to allow your child to participate, please sign below. However, your child does have a right to refuse to participate.

I hope that you will take this opportunity to allow your son or daughter to share comments on mathematics and mathematics education. If you have any questions about this survey or my research, please feel free to contact me at 865-974-2461. I appreciate your time and your cooperation.

Tracie McLemore Salinas

I have read the information above and will allow my son or daughter to participate in this research study. I understand that my name and my child's name will remain confidential.

Parent Signature: _____

Dear Student:

Dear Student:

Your school has been invited to participate in a study of students' perspectives on mathematics education. To participate, please complete the survey that follows. Remember, this is not a test. There are no right or wrong answers. Simply answer how you honestly feel about the subjects in the questionnaire or choose the responses that best describe you. **Your information will remain confidential, and no one in this school will ever see your answers.** Your responses will be added to those of other students from your school and similar schools to get an idea of your experience with and perspectives on mathematics education.

Most of the questions can be answered by writing the number that corresponds to your selection in a blank or by placing a checkmark next to your selection. Others ask for demographic information, such as your grade level, or mathematics courses taken. Write the answers for these questions on the lines provided.

By completing and turning in the survey, you acknowledge that you are willing for your responses to be included in my study and that you are aware that your information will remain confidential. You may, of course, choose not to participate, in which case you may either submit a blank survey or nothing at all.

To be able to participate, your parent or guardian must sign the attached consent form, and you must submit it with your survey. I hope you will take this opportunity to share your thoughts on mathematics and mathematics education in your community. If you have any questions, please feel free to contact me at 865-974-2461. Thank you for your time and your cooperation.

Sincerely,

Tracie McLemore Salinas
University of Tennessee

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1. What grade are you presently in? Place a check in the blank next to your grade.

   9^{th}_____ 10^{th}_____ 11^{th}_____ 12^{th}_____

2. What is your gender? Place a check in the blank next to the appropriate response.

   Male _____ Female _____

3. What occupation do you most want to have in the future?

   _____

4. What occupation do you *expect* to have in the future?

   _____

Please continue to next page →

School Name *Survey #*

5. What mathematics courses have you taken or will you take? Place a check in the appropriate column for each course.

Mathematics Course	Have Taken	Will Take	Will Not Take

6. Why have you chosen these particular mathematics courses? Place a check in the blank next to all that apply.

_____Required courses for graduation

_____Required courses for program of study

_____Preparation for college mathematics

_____Preparation for a job after high school

_____ Don't really have a choice

_____Nothing else to take

_____Enjoy mathematics courses

_____Parents' encouragement

_____Taking courses at my level

_____Don't know

7. How often do you talk with your parent or guardian about your mathematics courses or homework? Place a check in the appropriate blank. Please check only one.

_____ Every night

_____ Just once each week or so

_____ Never

_____ Two or three times each week

_____ Less than once each week

8. How often does your mathematics class present mathematical problems that are relevant to your community? Place a check in the appropriate blank. Please check only one.

_____ Every day

_____ More than once a month but not weekly

_____ Less than once a month

_____ Weekly

_____ Monthly

_____ Never

Please turn page over to continue →

School Name

Survey #

9. Mathematics is taught in high schools for a variety of reasons. How important is each of the following reasons to you for *your local high school* to teach mathematics?

Reach each of the following reasons. If you feel it is an extremely important reason for mathematical instruction, pick a number from the right side of the scale. If you feel it is extremely unimportant, pick a number from the left side of the scale. If you feel that the importance is somewhere between the two extremes, pick a number from somewhere in the center of the scale to show your opinion. Write the number that represents your opinion in the blank to the right of each reason.

Extremely Unimportant	1	2	3	4	5	Extremely Important

i. To help students earn a high school diploma....._____

ii. To prepare students for going to a technical or vocational school....._____

iii. To prepare students for going to a local community college....._____

iv. To prepare students for going to a university or four-year college....._____

v. To prepare students for a full time job in this community....._____

vi. To teach students to use mathematics in daily life....._____

vii. To teach students to use technology, such as calculators....._____

viii. To teach students to use mathematics to be good citizens....._____

ix. To prepare students for jobs in any communities....._____

x. To give students more educational and occupational choices....._____

10. How important is it to your parents that you do well in mathematics? Place a check in the blank next to the appropriate response. Check one for father and one for mother.

Father:		Mother:	
Very important	_____	Very Important	_____
Somewhat important	_____	Somewhat Important	_____
Not very important	_____	Not very important	_____
Don't know	_____	Don't know	_____
Does not apply	_____	Does not apply	_____

Please continue to next page→

School Name

Survey #

11. What does it mean to be successful in mathematics? How important is each of the following to being successful in mathematics?

Read each of the following. If you feel what is listed is extremely important to be successful in math, pick a number from the right side of the scale. If you feel it is extremely unimportant, pick a number from the left side of the scale. If you feel that the importance is somewhere between the two extremes, pick a number from somewhere in the center of the scale to show your opinion. Write the number that represents your opinion in the blank to the right of each reason.

Extremely Unimportant	1	2	3	4	5	Extremely Important

i. Earn A's in mathematics courses.....____

ii. Take an Algebra course or two.....____

iii. Take a Geometry course .....____

iv. Take advanced mathematics courses.....____

v. Complete the requirements for a high school diploma.....____

vi. Take more mathematics than is required for a diploma .....____

vii. Be prepared for mathematics in a community college.....____

viii. Be prepared for mathematics in a university.....____

ix. Use mathematics in your future career.....____

x. Learn to use mathematics in daily life.....____

xi. Learn to do mathematics on calculators .....____

xii. Learn to do mathematics using computers .....____

xiii. Work mathematics problems that are helpful to the community..____

xiv. Work mathematics problems successfully in groups.....____

xv. Learn to use mathematics in other classes.....____

Please turn page over to continue →

School Name *Survey #*

_____ May not finish high school

_____ Should graduate high school

_____ Should get a certificate from a vocational, trade, or business school

_____ Should get an Associate's Degree of two-year degree from a community college

_____ Should get a Bachelor's Degree from a four-year degree from a college or university

_____ Should get a graduate or professional degree

_____ Don't know

13. What is the occupation of your mother?

_____

14. What is the occupation of your father?

_____

15. What is the highest level of education completed by your mother and father? Place a check in the appropriate blank. Place one check in each column.

Father:		Mother:	
Less than high school	_____	Less than high school	_____
High school diploma	_____	High school diploma	_____
Certificate from a trade Or vocational school	_____	Certificate from a trade or vocational school	_____
Two-year degree	_____	Two-year degree	_____
Four-year degree	_____	Four-year degree	_____
Graduate/Professional Degree	_____	Graduate/professional degree	_____
Don't know	_____	Don't know	_____

Thank you for your time. Please seal this survey in the attached envelope and submit it in the manila envelope provided in your classroom. Thank you!

Remember that you must have turned in a signed parent consent form to have your survey included in this study.

Appendix B
Parent Questionnaire

November 19, 2003

Dear Parent:

I am a graduate student at The University of Tennessee conducting research on mathematics education, and I need your help. I'd like to know your thoughts on mathematics education in your life, your family, and your community. Your opinions are important to my research and may help schools such as yours to understand and use your ideas on mathematics in the future.

Please take a few moments to complete the enclosed survey and seal it in the attached envelope. Your son or daughter may return the survey to his or her high school where I will collect the surveys. There is no cost to you to participate, and the survey can be completed very quickly. I will combine your thoughts with those of many other respondents from your community for analysis. **In this way, your identity will remain confidential, and no one in your school district or community will see your responses.**

By completing and returning the survey, you agree to have your responses included in my research while keeping your identity confidential. You recognize that I will use your thoughts and those of others in your communities to describe parents' perspectives on mathematics and mathematics education. However, you do have a right to refuse to participate.

I hope that you will take this opportunity to share your comments on mathematics and mathematics education. I look forward to receiving your thoughts. If you have any questions about this survey or my research, please feel free to contact me at 865-974-2461. I appreciate your time and your cooperation.

Sincerely,

Tracie McLemore Salinas

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1. Consider the amount of mathematics necessary for students to graduate from your local high school. Choose one statement below that represents your thoughts on this amount; mark it by placing a check in the blank next to the appropriate statement. Please check only one.

_____ The school requires more mathematics than most students in this community need.

_____ The school requires an appropriate amount of mathematics for most students in this community.

_____ The school requires too little mathematics for most students in this community.

Please turn page over to continue →

School Name *Survey #*

2. Mathematics is taught in high schools for a variety of reasons. How important is each of the following reasons to you for *your local high school* to teach mathematics?

Reach each of the following reasons. If you feel it is an extremely important reason for mathematical instruction, pick a number from the right side of the scale. If you feel it is extremely unimportant, pick a number from the left side of the scale. If you feel that the importance is somewhere between the two extremes, pick a number from somewhere in the center of the scale to show your opinion. Write the number that represents your opinion in the blank to the left of each reason.

Extremely Unimportant	1	2	3	4	5	Extremely Important

i.____ To help students earn a high school diploma

ii.____ To prepare students for going to a technical or vocational school

iii.____ To prepare students for going to a local community college

iv.____ To prepare students for going to a university or four-year college

v.____ To prepare students for a job in this community

vi.____ To teach students to use mathematics in daily life

vii.____ To teach students to use technology, such as calculators

viii.____ To teach students to use mathematics to be good citizens

ix.____ To prepare students for jobs in any communities

x.____ To give students more educational and occupational choices

3. How often do you discuss mathematics class with your high-school aged son or daughter? Place a check next to the one response that fits best. Please check only one.

_____ Every night

_____ Two or three times each week

_____ Just once each week or so

_____ Less than once each week

_____ Never

Please continue on next page →

School Name *Survey #*

4. What do you consider success in mathematics for your high-school aged son or daughter? How important is each of the following to you in his or her schooling?

Read each of the following. If you feel it is extremely important that your son or daughter do what is listed, pick a number from the right side of the scale. If you feel it is extremely unimportant, pick a number from the left side of the scale. If you feel that the importance is somewhere between the two extremes, pick a number from somewhere in the center of the scale to show your opinion. Write the number that represents your opinion in the blank to the left of each reason.

Extremely Unimportant	1	2	3	4	5	Extremely Important

i. _____ Earn A's in mathematics courses

ii. _____ Take an Algebra course

iii. _____ Take a Geometry course

iv. _____ Take advanced mathematics courses

v. _____ Complete the requirements for a high school diploma

vi. _____ Take more mathematics than is required for a diploma

vii. _____ Be prepared for mathematics in a community college

viii. _____ Be prepared for mathematics in a university

ix. _____ Use mathematics in his or her future career

x. _____ Learn to use mathematics in daily life

xi. _____ Learn to do mathematics on calculators

xii. _____ Learn to do mathematics using computers

xiii. _____ Work mathematics problems that are helpful to the community

xiv. _____ Work mathematics problems successfully in groups

xv. _____ Learn to use mathematics in other courses

Please turn page over to continue →

School Name *Survey #*

5. How far would you like to see your high-school aged son or daughter go in school? Place a check in the blank next to the one response that fits best. Please check only one.

_____ Should graduate high school

_____ Should get a certificate from a vocational, trade, or business school

_____ Should get an Associate's Degree or 2-year degree from a community college

_____ Should get a Bachelor's Degree or 4-year degree from a college or university

_____ Should get a master's, doctorate, or professional degree

_____ Don't know

6. How often do you use mathematics on the job? Place a check in the blank if the given statement is true. If it is not true, leave the blank empty. Please check as many as are true.
If you are not currently working, please skip to question 10.

_____ I use basic mathematics every day.

_____ I sometimes use basic mathematics but not every day.

_____ I use geometry every day.

_____ I sometimes use geometry, but not every day.

_____ I use a calculator or adding machine regularly.

_____ My job requires me to measure weights, distances, or temperatures.

_____ I often use mathematical thinking on the job to solve problems.

_____ I often use advanced mathematics at work.

_____ My job does not require me to use mathematics at all.

_____ Mathematics is very important to my job.

7. What is your occupation?

_____

8. What is your gender? Place a check in the appropriate blank.

Male _____ Female _____

Thank you for your participation! Please send this survey to High School Name with your child.

School Name *Survey #*

Appendix C
Teacher Information Sheet

Dear Teacher:

Your high school is one of four in east Tennessee to be invited to participate in a University of Tennessee research study on student and parent perspectives on mathematics education. The participation of your students is vital to this research, and I appreciate your assisting me in distributing the attached surveys. I have provided step-by-step directions to make this simpler to you and to aid in my collection of the results.

1. Distribute the surveys to students in your first period class on Wednesday, November 19. Read the following directions to students:

Our school has been invited to participate in a research study for The University of Tennessee. You are being given a survey to complete and return in the manila envelopes that I have here. Take the survey home so that your parents may sign the cover sheet. It is a permission sheet that must be signed to allow you to participate. Some of you may also have a survey for your parents attached to your survey. Please take that survey home for your parents to complete. Bring all completed surveys back to class as soon as possible and place them in the manila envelopes. The last date to turn in your surveys is November 24.

2. Make the manila envelopes that are labeled for collecting student and parent surveys available in your classroom for students to submit their surveys.

3. Remind students each day in your first period class to turn in the surveys.

4. On Monday, November 24, seal the two manila envelopes containing the parent and student surveys. Drop them in the designated box in the school office or teacher workroom.

If you have any questions about this research, please feel free to contact me at 865-974-2461.

Thank you for your participation.

Tracie McLemore Salinas

VITA

Tracie Michelle McLemore Salinas was born in Hattiesburg, Mississippi, and lived most of her life in the nearby communities of Morriston and Eastabuchie. She attended school in the Petal School District, graduating from Petal High School in 1991. Tracie entered William Carey College of Hattiesburg, Mississippi, in 1992 as a history major but soon added the mathematics major as well. She completed the Bachelor of Science degree with a double major in 1996 then entered graduate school at The University of Tennessee in 1997.

While at The University of Tennessee, Tracie completed the Master of Science degree in Education and began teaching for the Department of Mathematics in 2000. She began taking additional courses and soon enrolled in a doctoral program. Tracie completed the Doctor of Philosophy degree with a concentration in curriculum and a specialization in mathematics education in May 2004.

Tracie is currently a lecturer in the UT Department of Mathematics and an internship supervisor for the Rural Internship Program of The College of Education, Health, and Human Sciences.

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