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Community College Students' Perceptions of Their Rural High School Mathematics Experience

Caroline Munn Best
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To the Graduate Council:

I am submitting herewith a dissertation written by Caroline Munn Best entitled "Community College Students' Perceptions of Their Rural High School Mathematics Experience." I have examined the final electronic 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.

Vena M. Long, Major Professor

We have read this dissertation and recommend its acceptance:

P. Mark Taylor, Kristen T. Rearden, Charles R. Collins

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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_Kristen T. Rearden_____

_Charles R. Collins_____

Accepted for the Council:

___Anne Mayhew_____
Vice Chancellor and Dean of
Graduate Studies

(Original signatures are on file with official student records.)

COMMUNITY COLLEGE STUDENTS' PERCEPTIONS OF THEIR RURAL HIGH SCHOOL MATHEMATICS EXPERIENCE

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Caroline Munn Best
December 2006

DEDICATION

This dissertation is dedicated to my parents, Sarah and Al Munn,

who taught me to finish every project I start

and

to the ACCLAIM 2002 Cohort

whose friendship and support encouraged me to “get it done.”

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I wish to thank all of those who helped me with the research and the writing of this dissertation:

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My husband, Ed, and children, Sarah, Katherine and John: Thank you for helping me through this project. Your support was invaluable, and I love each of you.

ABSTRACT

This qualitative study explores mathematics education from the perspective of community college students who are recent graduates of a rural high school. The research questions relate to the students' perception of their understanding of rural, their rural high school experience, the factors that contributed to their preparedness or lack of preparedness for college-level mathematics, and the effect that their rural education had on their preparation for college. Students enrolled in a mathematics course at a suburban community college in East Tennessee were asked to complete a survey after midterm of fall semester 2005. Information about the location of their high school, age, and whether they consider themselves rural were used to screen students for an interview. Students were purposefully selected who graduated from one of eight rural high schools located in counties with an economic status of *transitional* or *at-risk*, were between the ages of 18 and 24, and responded to an email sent to set-up a time for an interview. Eighteen students were interviewed after midterm fall semester 2005 with follow-up interviews with seven students the following spring semester. Findings include the following: students from at-risk counties equate rural with isolated, country, and poor; students who graduated from rural high schools in transitional counties do not see rural as a major factor in their education compared to students from at-risk counties; and students from schools in at-risk counties are negative about their high school mathematics experience. Factors stated by these students overwhelmingly fault the teacher's ability to explain the math, teacher favoritism toward certain students, unconcerned attitude of teacher, and the low expectations of teachers and the school administration.

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Chapter I

INTRODUCTION

In an article written in 2005 for the Nashville newspaper, *The Tennessean*, Leon Alligood describes a sentimental picture of rural:

> …rural is elbow room, the faint smell of manure and silage, small town cafes where sun-bronzed farmers gather in the morning for coffee and scrambled eggs, water tanks spray-painted with "Go Wildcats" or "John loves Suzy," traffic jams caused when a corn combine ambles down a state highway moving from one field to another and, on a cloudless night, a universe of stars twinkling from horizon to horizon.

Ask a young person to describe rural and the images that may be expressed depict economically depressed or geographically isolated communities that have few profitable resources (DeYoung, 2002). Rather than describing a rural community as one composed of individuals who embrace peace, solitude, and family values, the typical image may be one where residents are "rednecks," "hillbillies," "hicks," or "country bumpkins" (Herzog & Pittman, 1995). Rural, southern Appalachian communities are still identified as places where people have close ties with neighbors, and communities share common histories and values (Howley, Harmon, & Leopold, 1996). Agriculture, manufacturing, and mining no longer dominate the rural economy of the South and have been replaced by service-based, part-time employment. Alligood (2005) writes that "only one county out of the Tennessee's 95 is considered by the federal Department of Agriculture to have

a farm-dependent economy, where agriculture is the primary economic engine…While agriculture nets about $2 million dollars in sales in Tennessee, it's dwarfed by the income of manufacturing and service industries." In the old economy, workers could earn a decent living with an eighth grade education; now overseas competition has reduced the number of manufacturing jobs (U.S. Department of Agriculture, 2003), and employers want an educated and skilled workforce. Rural areas are more likely to have a single industry control the economy, thus making the worker more vulnerable to lay-offs. Rural Appalachian areas are now attracting tourists and wealthy retirees and have a higher proportion of low-wage, low-benefit jobs than urban areas. Therefore, young people are leaving to find work in nonrural areas, usually cities, which offer better jobs with higher salaries (Kannapel & DeYoung, 1999). This migration between rural and metropolitan areas is a major factor in population growth and decline (Herzog & Pittman, 1995). The need for rural economic development is obvious, especially in isolated and depressed areas. Most observers agree that schools have a role to play in this process.

The focus of this study is students who graduated from a rural high school and attend a community college in the Appalachian region, the area of land stretching along the Appalachian Mountain range. All of West Virginia is in Appalachia as well as parts of twelve other states from New York to Mississippi. This region has become increasingly varied, with culturally and ethnically diverse urban centers emerging in every state. Still, rural Appalachia remains predominantly white. This area is economically disadvantaged with family and per capita income significantly lower compared to income levels across the United States. Not surprisingly, the rates of

unemployment as well as dependency on state and federal supplemental income are high (Chenoweth & Galliher, 2004). Poverty is the strongest and most continuing threat to high school achievement (Rural School and Community Trust, 2004).

DeYoung (2002) reminds us that historically the role of schooling, including rural, was not for academic achievement, but for character training and for very basic instructional skills. In Appalachia, schools were part of the community, and students were taught skills that would perpetuate the community. More recently, schools have become the place where young people learn academic skills that will equip them to leave the community. Educated young people are often overqualified to work in the local community and must leave to find work commensurate with their qualifications or education. Many rural students are not eager to leave their families and communities and subsequently decide to take lower paying jobs just to stay close to home.

Rural schools and districts are typically small. Khattri, Riley, and Kane (1997) state that this is an advantage since small schools are in many ways more effective than large schools. Small schools tend to foster a positive school climate, an orderly environment, a high level of student-faculty engagement, and better school-community relations. Seal and Harmon (1995) describe rural schools in Appalachia as more than just classrooms, but as cultural and social centers. The school embodies pride in values, such as discipline and hard work, from the previous generation. Rural schools can provide students with educational opportunities outside the classroom walls. This ability to use the community as a natural resource supports student learning and involves the student in seeking solutions to local problems (Khattri et al.,1997; Long, Bush, & Theopold, 2003).

In 1896, national politicians and educators declared rural schools ineffective, inefficient, and inferior to their urban counterparts. The solution was to centralize and bureaucratize the management of schools through consolidation, and to upgrade academic standards through professionalization of teaching (Kannapel & DeYoung, 1999). These urban style reforms were forced on rural schools with the urban model held as the goal for educational excellence (DeYoung, 2002). With declining rural enrollments, large, centrally located consolidated schools were built despite the opposition of the local rural community. Other incentives for consolidating schools were improved transportation, increased curricular offerings, and appeasement of state financial woes.

Today, rural school systems are faced with sparse population and school funding formulas based on the local tax base, poor physical facilities, fewer classroom resources, and lack of qualified teachers (Arnold, 2000; The Education Alliance, 2004). Despite consolidation, many rural schools have smaller enrollments than do urban schools. Every state has initiated a set of accountability standards making student achievement tests mandatory. According to Gibbs and Howley (2000), these state standards diminish local control and reduce the connection between schools and community. Schools must teach a curriculum and use teaching methods that are counterproductive to the advantages of the rural school. The No Child Left Behind (NCLB) legislation requiring a highly qualified teacher in every classroom has adversely affected rural schools. Many rural teachers are required to teach several subjects which they may not be qualified to teach according to NCLB guidelines (Phillips, 2003). Although rural Americans have more years of

schooling than ever before, rural youth are less likely to take college-preparatory classes and to attend college than their urban counterparts (Stern, 1994). This trend is likely determined by the few economic opportunities that are available in the local community.

Hatfield (2002) claims that a culture of failure in school mathematics exists and permeates rural communities. This means that failure to understand or achieve in mathematics is socially acceptable. Hatfield challenges mathematics educators to search for, and discover, the unique, contextual factors that apply to teaching mathematics to rural children. This challenge is echoed in the mission statement of the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM), one of the 15 Centers for Learning and Teaching funded by the National Science Foundation (Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics [ACCLAIM], 2002). ACCLAIM seeks to "examine rural schools as they serve or subvert the development of mathematical knowledge and expertise…." (ACCLAIM, 2002, p.2).

Statement of Problem

Mathematicians and math educators have failed to focus on the rural culture with the same enthusiasm and depth as they have taken on urban issues. Bush (2005) cites Kannapel and DeYoung (1999) saying that "rural areas are ignored by national movements" (p. 2) with state and national standards conflicting with community needs in many rural areas. For many educators, Appalachia denotes a place of deprivation, despair, and backwardness (Howley, Harmon, & Leopold, 1996). This cultural view has influenced the American people to also view the Appalachian people and the educational

system in the same manner. As smaller schools were consolidated into larger, more efficient ones, many people perceive rural schooling as deficient (Bard, Gardener & Wieland, 2005). Educators know little about the communities where these students live, or how satisfied the students are with their schools and communities. The goals of this study are to identify and appreciate the students' talents, gifts, and rural values, and to learn about the mathematics education they received in a rural high school.

Purpose of the Study

This study will explore rural high school mathematics education from the perspective of East Tennessee, community college students. The students are rural high school graduates attending Pellissippi State Technical Community College (PSTCC) and are either placed into a college-level or a developmental mathematics course, according to their placement score on the ACT or ASSET mathematics test. Participants in the study are traditional-age, between the ages of 18 and 25.

Research Questions

The purpose of this study is to investigate the following questions:

1. What are the students' perceptions of growing up rural?
2. What are the students' perceptions of their rural high school mathematics experience?
3. What are the students' perceptions of the factors that contributed to their preparedness or lack of preparedness to take college-level mathematics?

4. What are the students' perceptions of the effect that growing up rural had on their high school mathematics experience and their preparedness for college-level mathematics?

Basic Assumptions

I will assume the following statements are true.

1. The student is honest in describing his or her high school experiences.
2. The method of determining a student's ruralness using the definition of the Census Bureau and the Tennessee Department of Education is accurate.
3. The researcher's analysis is comprehensive, and the findings are correctly described.

Research Methods, Procedures, and Analysis

I surveyed all sections of developmental and entry-level college mathematics at PSTCC during fall semester 2005. I determined which students were of traditional age and graduated from high schools classified rural according to the Census Bureau's definition used by the National Center for Educational Statistics (NCES). Each student was asked to indicate his or her gender and rural, suburban, or urban identification. From this population, I sorted students into categories according to gender, developmental or college-level mathematics status, and self-identification. The student's high school transcript and student information system at PSTCC were used to build a profile for each student. Using this information, I purposefully selected students from each category to contact for interviews.

I used the principles of grounded theory to guide me through data gathering and analysis. Data was collected from interviews. I interviewed students in an appropriate area on one of the three campuses, Parkway, Division Street, or Magnolia Avenue, or the Blount County center. A professional transcriptionist recorded each interview. I read each interview looking for themes and categories and identified the major domains, based on a rereading of the data, and assigned each a code. As data collection continued, this step was repeated. After the last interview was completed and analyzed, I made a rough outline of the salient domains and then reread the data looking for the included terms. I marked excerpts in the data that supported or did not support the relationship and searched for themes across the domains by constantly looking for similarities and differences among the domains. I created a master outline stating the relationships within and among domains and then reread the data selecting quotes to support my findings and included them in the outline. From the outline, I wrote the findings.

Definition of Terms

Rural: Schools designated by National Center for Educational Statistics (NCES) as Rural Inside or Outside Metropolitan Statistical Areas (MSAs) are classified as rural for the purposes of this study. Urban area (UA) and urban cluster (UC) consists of area with a population density of at least 1,000 people per square mile and surrounding areas that have an overall density of at least 500 people per square mile. Rural consists of all territory, population and housing units located outside of UAs and UCs.

Rural/outside Core Based Statistical Area (CBSA): Any incorporated place, Census designated place, or non-place territory not within a CBSA or Consolidated Statistical Area (CSA) of a Large or Mid-size City and defined as rural by the Census Bureau.

Rural/inside CBSA: Any incorporated place, Census designated place, or non-place territory within a CBSA or CSA of a Large or Mid-size City and defined as rural by the Census Bureau. (http://nces.ed.gov/ccd/Rural_Locales.asp)

Developmental Mathematics: non-credit mathematics courses at the community college level for students who need remediation in mathematics based on standardized placement test scores. Developmental mathematics courses are part of the Developmental Studies Program (DSP) in Tennessee and are referred to as DSPM courses. Developmental mathematics courses consist of basic mathematics (DSPM 0700), elementary algebra (DSPM 0800), and intermediate algebra (DSPM 0850). Students under the age of 21 in Tennessee take the ACT during high school or at the testing center at the community college. Scores on the ACT Mathematics Assessment range from 0 to thirty-six. Table 1 indicated how placement is determined. The student may retake the ACT to achieve higher placement. The table on the ACT website relates the scores on the ACT mathematics' test to skills taught in high school mathematics classes. (http://www.act.org/standard/planact/math/index.html

Students 21 years of age or above take the ASSET test, a placement test developed by ACT. Each of the ASSET mathematics tests is multiple choice. The basic skills test consists of 25 questions with 25 minutes allowed to take the test. A calculator is not allowed. Students can also choose to take the Elementary Algebra test or the Intermediate Algebra test. Each of these tests consists of 25 problems with 25 minutes allowed to take the test. A calculator is allowed on the algebra tests. Typically, a student will take two tests, either the numerical skills and the elementary algebra tests, or the elementary and intermediate algebra tests, depending on the student's mathematical background. The ASSET test is given in the testing center at PSTCC. (http://www.act.org/asset/pdf/guide.pdf)

College-level Mathematics: mathematics courses starting with the entry level courses of: MATH 1010 Foundation of Mathematics, MATH 1130 College Algebra, MATH 1410 The Structure of the Number System, MATH 1530 Elementary Probability and Statistics, MATH 1730 Precalculus. Even though the topics are taught in many high school mathematics courses, these courses are traditionally considered college-level with college credit. All of these are transferable courses to the University of Tennessee Knoxville (UTK) and institutions within the Tennessee Board of Regents (TBR) system.

Table 1 Cut-off Scores for Placement in DSPM

Score Range	Placement
0 - 14	DSPM 0700 Basic Mathematics
15 - 16	DSPM 0800 Elementary Algebra
17 - 18	DSPM 0850 Intermediate Algebra
19 or above	College-level Mathematics

Algebra 1 Gateway Test: Students entering ninth grade during the 2001-2002 school year must be Proficient or Advanced on the Algebra 1 Gateway test to receive a diploma. The following table shows the scores needed to meet the Proficient and Advanced Levels on the Gateway examination. These scores were determined by the State Department of Education after field-testing. The test contains sixty-two multiple-choice questions. The scores are the total number of questions marked correctly. A graphing calculator and a reference page with formulas and equations are allowed. Students may retake the Gateway test if needed. For Summer 2005, the passing scores, presented as number of items answered correctly, are in Table 2.

Traditional Students: students under the age of 25 who enter college immediately following graduation from high school.

At-Risk Counties: counties at risk of becoming economically distressed. These counties have three-year average unemployment rates at least 1.25 times the national average, per capita market income no greater than two-thirds of the national average, and poverty rates at least 1.25 times the national average; or they meet the criteria for two of the three distressed-level indicators. This economic level was adopted in fiscal year 2006 for the purpose of monitoring economic change and planning for investments in potentially distressed counties.

Transitional Counties: counties that have rates worse than the national average for one or more of the three economic indicators (three-year average unemployment, per capita market income, and poverty) but do not meet the criteria for the distressed or at-risk levels. At-risk and Transitional are two of five County Economic Status Designations in the Appalachian region for fiscal year 2006 determined by the Appalachian Regional Commission (ARC). A description of each economic level is provided at the ARC website.
http://www.arc.gov/index.do?nodeId=2934

Table 2 Cut-off Scores for the Gateway Algebra I Test

Gateway	Algebra I
Advanced	42
Proficient	30

Limitations

This study depended upon the honesty and openness of the students interviewed. Students interviewed were enrolled at the community college fall semester 2005 and who consented to an interview. This meant that the student was most likely still attending class and had time in his or her schedule of classes for an interview. These two factors impacted the students interviewed.

Delimitations

Students were classified as rural according to the high school from which they graduated. Many students did not feel that they grew up in a rural community or that their ruralness affected their mathematics education.

The data is a representation only of the population being studied. The results may not transfer to other community colleges.

Organization of the Study

The study is divided into five chapters. Chapter One is an introduction to the study - stating the problem, purpose, and need for the study. In addition, Chapter One includes the limitations, the delimitations, and assumptions of the study, defines relevant terms, and states the research questions. Chapter Two is the review of the literature on rural communities, schools, and mathematics education. Community colleges, developmental education, and gender are also discussed. Chapter Three describes the theoretical framework and methodology. The findings are stated in Chapter Four, and a discussion of the findings, reflections, and recommendations are in Chapter Five. A list of references and appendices conclude the study.

Chapter II

REVIEW OF THE LITERATURE

Growing Up Rural

In 1994 Stern wrote that "all Americans have a stake in the health and well-being of Rural America"(p.1). She states that the United States has depended upon the resources and family values of rural America to build its material wealth, stable communities, and local businesses. But, rural communities are experiencing change, and this change continues to undermine the good and unique qualities of rural America. Economic disruption, out-migration of the better educated, and growing poverty are three major forces driving this change. The National Center on Addiction and Substance Abuse (CASA) researched the growing problem of alcohol and drug abuse, gang activity, adolescent pregnancy, and homelessness and found rural students just as involved as urban students in these activities, and in some cases, even more so (Rouk, 2001). A workshop hosted by East Tennessee State University College of Public and Allied Health in 2005 brought together 30 community and educational stakeholders from six different states. The group discussed the problem of substance abuse in Appalachia, concluding that "the problem impacts entire communities and the region, is widespread and underreported…" (p.2).

If these statements are true in 2006, rural students are valuable to the future of our country, and the changing characteristics of rural students, schools and communities should be of concern to educators. The following sections present current issues regarding rural students, school, and communities.

Rural Students

Rural students tend to be Caucasian and attend schools with a low minority enrollment, although the distribution of minority students varies greatly from region to region. Rural students are less likely to be living with single parents and have a college-educated parent than urban or suburban students (Herzog & Pittman, 1995). Blackwell and McLaughlin (1999) used data from surveys of 1,180 rural and 4,384 urban young people and found that rural youth have only slightly lower educational goals than do urban youth, partly because they are less likely to have educated parents with professional occupations. Hektner's study (1995) of eighth, tenth, and twelfth graders in the Midwest found that rural youth, especially males, feel "more angry and empty about their futures"(p. 12), validating the conflict that rural youth experience over whether to stay or leave their family, friends, and community to find better jobs or educational opportunities. In rural Appalachia, high school students have lower educational aspirations than their urban or suburban counterparts and struggle with the need to leave the area to find work or further their education (Howley, Harmon, & Leopold, 1996).

Rural Schools

Khattri, Riley, and Kane (1997) cite research indicating that rural schools have characteristics that help students be successful. Rural schools are typically smaller and more effective that large urban schools in providing educational and social resources. Other advantages of rural schools include their close connection with the surrounding community and the many educational opportunities outside the classroom afforded by the community. Research by Tompkins and Deloney (1994) indicates that the small size and

tight knit social structure of rural communities promotes parental involvement, which in turn is an important factor in student success.

On the other hand, small schools typically cannot provide the advanced or college preparatory course work, and special programs, such as the gifted and talented, are limited. The quality of teachers is a major problem in rural areas (Schwartzbeck & Prince, 2003), and technology has not been implemented in rural schools to the same extent as in non-rural schools (Griffin, 2005). Rural schools often lack the monetary resources to fund improvements, and the "rural school educators cite lack of time and the fact that they already 'wear many hats' as major barriers to change" (North Central Regional Education Laboratory [NCREL], 2003, p.2).

Bush (2005) states that rural schools share many of the characteristics of poor schools reported by Haberman (1991). Among these are a curriculum that is irrelevant to the lives of the students and the passive role of the student in the learning process. In contrast, Stern (1994) argues that rural schools tend to be better places for learning compared to their urban or suburban counterparts in terms of teacher and student absenteeism, learning environment, student misbehavior, and alcohol and drug use. Since 1994, others maintain that rural schools and communities have adopted a more urban lifestyle, buying into "standardization, specialization, competition, capitalism, and consumerism" that characterize larger population areas (Harmon, 1999, p.22). Rouk (2001) blames the

> growing social problems to the cultural transition that is altering the rural landscape. Communication technologies

> including satellite television and the Internet have contributed greatly to relieving some of the isolation that rural youth face. On the flip side, these technologies have initiated rural youth to urban culture, including gang culture and dress. (p. 2)

Rouk contends that despite the changing nature of the community, "schools remain the one institution in rural communities around which most residents are likely to rally on behalf of their youth" (p. 3).

Rural Communities

Rural communities are often isolated geographically and culturally, have limited economic development, and have restricted educational and cultural activities (McCombs & Bansberg, 1997). There are many disadvantages to living in southern, rural communities, such as a weak and declining business base, inability to generate adequate tax base, isolation from growing jobs, aging public facilities, difficulties attracting and retaining qualified teachers, and the poverty level (Southern Governors' Association, 2004). Compared to urban areas, Kannapel and DeYoung (1999) state that rural areas have a higher proportion of low-wage, low-benefit jobs. Rural per capita income in Tennessee is well below the national median for per capita income. Rural per capita income not only measures poverty, but the level of economic distress and well-being among rural people (Johnson & Strange, 2005). For many years in the south, agriculture was the dominant employer, but this has changed to production or laborer jobs in manufacturing or low-skilled managerial positions. Therefore, many people drive to

urban areas for work, shopping, and health care. The rural community looses the loyalty of its inhabitants and its capacity to be a change agent (Hobbs, 1994; Rouk, 2001).

Despite these negative attributes, rural communities still have social characteristics that make them safer and friendlier places to live, and the citizens typically have traditional values of discipline and hard work. Howley et al. (1996) found that the people of the southern Appalachians have a strong identification with place and close ties with others in their community. This identification with place, known in educational circles as place-based education, can "create a link between what students are learning and how that relates to the world around them. It attempts to build students' pride in the community where they live. " (NCREL, 2003, p. 2) Long et al. (2003) state that place-based pedagogy and curriculum tries "to reverse the out-migration of rural youth and the devaluing of rural communities" (p. 4). The drawbacks to place-based mathematics education discussed by Bush (2005) are significant; lessons that are developed by teachers for specific locales "provide a limited view of mathematics…[Students] do not always engage in mathematics as an axiomatic system, as a way of thinking…or communicating" (p. 7). Nevertheless, if rural communities work with school leaders, and provide "the ongoing interest, encouragement, support, and resources" (NCREL, 2003, p. 2), rural education may not be viewed as deficient, a situation from which students must "be rescued" (ACCLAIM, 2002, p.2). Since this study concerns the mathematics education of rural students in the Appalachian region of Tennessee who attend a suburban community college, issues particular to this area and these students are considered.

Rural Education in Tennessee

Why Rural Matters 2005, a report by the Rural School and Community Trust, states that in Tennessee nearly half (47.3%) of rural students are eligible for subsidized meals. Subsidized meal rate is the most common measure of student poverty used in educational research. Eleven states have more than fifty percent of all rural students eligible for free or reduced price meals; Tennessee ranks twelfth. In Tennessee, adult educational attainment is the third lowest in the United States; rural spending for instruction is among the nation's lowest; and graduation rates and NAEP scores are below national medians (Johnson & Strange, 2005).

Mathematics Achievement in Rural Schools

Three recent quantitative research studies provide a comprehensive description of mathematics achievement of rural students. Haller, Monk, and Tien (1993) studied 2,829 students enrolled in the tenth grade in the fall of 1987 from 51 randomly selected schools across the nation. A sample of students, their teachers, and their parents completed survey instruments. Results of the study showed that school size has no effect on higher-order skills in either mathematics or science achievement. Both school size and rurality are related to course offerings as expected. Howley (2003) pointed out that one problem in this study is that national averages hide a great deal of variation among specific rural regions. On the other hand, Fan and Chen (1999) used data from the National Education Longitudinal Study of 1988. Their study followed a sample of 24,500 students from the eighth grade through the twelfth grade. Fan and Chen found that students from rural schools perform as well as their peers in metropolitan areas. A third study by Lee and

McIntire (2000) went a step further by investigating state-level differences in rural versus non-rural mathematics achievement. Lee and McIntire conducted a systematic study of National Assessment of Education Progress (NAEP) national and state mathematics assessments of eighth graders in 35 states. Overall, students in the nation's rural schools showed highly comparable levels of achievement relative to their non-rural counterparts in 1992 NAEP eighth grade math. By 1996, rural students started to outperform non-rural students. Lee and McIntire also found substantial variations among states in rural student achievement and schooling conditions.

From these assessments, Howley (2003) concludes that a gap in national rural versus non-rural achievement does not exist. Neither does a national rural versus suburban, nor a national rural versus urban mathematics gap exist. At the state level, a rural versus non-rural achievement gap exists in 40% of the states – half favoring rural students.

In 2000, the Southern Regional Education Board's (SREB) high school improvement initiative assessed the mathematics achievement of 1,900 twelfth graders in 24 clusters of rural high schools in seven states using an exam referenced to the NAEP. Twelfth graders had a mean mathematics score of 297, at the lower end of the Basic range (297 to 327), with 39% of the students scoring below the Basic level and 13% scoring at the Proficient level or above. Students completing more than the recommended high school curriculum of at least three credits in mathematics with at least two being college-prep level had mean scores ranging from 312 to 322 with a mean score of 321. In contrast, twelfth graders who completed only the recommended high school curriculum

had a mean score of 296, one point below the Basic level. Students who completed less than the recommended curriculum had mean scores of 278. Students who took mathematics during their senior year had a higher mean score than students who did not. This study found that these schools put little emphasis on high expectation and quality student work and failed to provide their students with the kind of support that is needed to enter and succeed in higher-level mathematics courses (Bottoms & Carpenter, 2003).

Gender has long been a factor in academic achievement. The Third International Mathematics and Science Study (TIMMS), an international assessment that included math achievement and participation in advanced level mathematics courses, found achievement differences between gender groups in all of the participating 45 countries except South Africa. Coladarci and McIntire (1988) used the High School and Beyond database, a nationally representative sample of U. S. high school seniors in 1980, for their research on gender and urbanicity. The number of students studied varied from 9,849 to 10,064. The mathematics ability measure consisted of 33 items that called for quantitative comparisons. With socioeconomic status (SES) controlled, they found that gender and context (rural, suburban, and urban schools) had negligible to little effect on mathematics scores. In contrast, Hopkins (2004) found in her study of mathematics achievement of students in Tennessee as reported on the 2003 Report Card that course enrollment varies significantly between males and females. Her findings include the following: a greater percentage of males enrolled in the entry-level mathematics courses Foundations I and II;

females enrolled in higher percentages in Algebra II, Geometry, Advanced Algebra, and Precalculus; males outscored females across locale, location, and SES on the ACT mathematics test.

Community Colleges

History and Mission

At the beginning of the twentieth century, there was great diversity in the quality and availability of secondary education. Junior colleges came about as part of the restructuring of secondary education. Junior high schools and junior colleges developed concurrently from 1910 to 1920. Junior colleges provided the first two years of a four-year program at a university and were organized under the "auspices and authority of the local school districts" (Boswell, 2000, p. 1). During the 1960's, states transferred the governance of junior colleges to postsecondary governing boards. By 1970, junior colleges were renamed community colleges reflecting the emphasis of the college on the educational needs of the community. Providing for the diversity of a larger student body became the challenge of the college (Gleazer, 1994). Community colleges are not to be equated with two-year colleges. Adelman (2005) differentiates between the two with the following definitions:

> A community college is a public institution in which the modal degree awarded is the associates. The category of two-year college is larger… Two-year colleges also include (a) two-year, associate degree-granting branch campuses of four-year institutions, (b) two-year, private not-for-

profit associate degree-granting institutions, and (c) any for-profit institution at which the degree awarded is the associate. (p. 12)

Community colleges have an open-door admissions policy stating that any high school graduate can enroll. Before this policy, the traditional college student was a white, adolescent male from a typical family paying his tuition. As a result of this policy, students were admitted unprepared to do college-level work. These students were women who postponed going to college for family and work, people with a midlife career change, students of color, and physically challenged students. In 1993, only 43% of America's higher education students were considered traditional (Martens, Cordova, & Harris, 1995). Now, community college students are more diverse than those in any other public education institution. Female students account for 58% of the students. Half of the students work part-time, a third work full-time, and 30% of all students enrolled full-time also work full-time. The average age is 29, and almost one third of the students receive some financial aid (Rosenfeld, 2001).

Adelman (2005) states that in order to best describe and understand community-college students, age must first be considered. Traditional-aged students have different backgrounds, family and job commitments, and consequent academic behavior and progress compared to older students. Traditional-age students break down into six populations: (1) a "persistent group" with the goal of transferring and earning a bachelor's degree, (2) an "equally persistent group" with the goal of earning an associate's degree, (3) a "group with weaker secondary school preparation" (p. 118) who struggle and quit, (4) a group that flees at the beginning, (5) temporary transfer students

who are based at other colleges, often a four-year school, (6) a small group of students who started out at the four-year school, changed their mind about a four-year degree, and ended up at the community college.

The comprehensive mission of today's community college is to provide educational services to local communities. These include transfer programs, literacy and language skill development, remedial and developmental education, career counseling and vocational training, and community cultural classes and events (Gleazer, 1994). Education beyond high school is a must according to Stanford University economist Paul Romer (Friedman, 2005). He goes on to say that the government must creatively encourage students to pursue post secondary education, just as the high school movement, the GI Bill, and the modern university encouraged students in the twentieth century. The result of post secondary education will qualify more people for the technical jobs of the 21st century, but it also "shrinks the pool of people able to do lower-skilled work, from road maintenance to home repair… By shrinking the pool of lower-skilled workers, we help stabilize their wages…because there are fewer people available to do those jobs" (p. 289).

Remedial/Developmental Education

Remedial and developmental coursework at the collegiate level provides an opportunity for many students to pursue a college education. For many students, developmental coursework represents a "second" chance for those who did not get an appropriate high school education, or who did not pursue higher education immediately after high school (State Board of Regents, 1984).

Brier (1984) states that colleges and universities have always offered precollege-level courses designed to teach the academic skills necessary for success in college. Traditionally, these remedial classes were only concerned with the improvement of academic skills. But students needed much more than just refresher courses; there were many other factors involved in academic success such as self-confidence, study behaviors, and social competence. The combining of remedial instruction with personal and academic development puts a different perspective on what have been called remedial courses. Since 1970, developmental education has recognized contributions from the fields of cognitive and developmental psychology. Today's developmental education includes all forms of learning assistance and personal development. The NCES data for 1995 estimates that 40% of each year's incoming students at the average community college are to some extent inadequately prepared (Boylan, 2001). The causes are many and are often the result of socioeconomic, cultural, and individual differences (Spann, 2000).

The current political controversy over the need and place for remediation is heated. Merisotis and Phipps (2000) in a Maryland study found that of "students who completed a college preparatory curriculum" in high school and went "directly to a community college, 40% still needed math remediation" (Oudenhoven, 2002, p. 39). Therefore, the question "Why are high schools not preparing students for college?" is an important one. Opponents to college remediation argue that the availability of remedial courses removes the incentives for students to do well in high school. Boswell (2000) states, "Critics of community colleges argue that the mere existence of 'second chance'

open-door institutions has encouraged students to take demanding college admissions lightly"(p.3). At the college-level, remedial courses take away from the education of prepared students by "dumbing down" courses. Many four-year colleges and universities make a case that developmental/remedial courses don't belong on their campuses and should be relegated to the community college. Damashek (1999) uses the work of Zumeta (1998) and Boylan (1995) to argue that this would create an "academic caste system" (p. 2) between two- and four-year schools and may limit opportunities for students and enrollment for four-year schools. Ignash (1997) cites the fall 1995 NCES study that found state policies tended to designate community colleges as the "preferred provider of remediation" (p. 8). She claims that educators believe that this is best since the emphasis at community colleges is on teaching and learning, and the cost of instruction is lower.

Characteristics of Developmental Students

Saxon and Boylan (1999) describe developmental students as "at-risk, remedial, low-achievers, disadvantaged, non-traditional, and skill-deficient" (p.1). The researchers collected information from 18 studies on the characteristics of remedial students. They found that females accounted for 53% to 57% of the total students needing remediation, consistent with first-time community college students in general, and the average age was 23. The majority of remedial students were Caucasian (Boylan, Bonham, & Bliss, 1994). Slightly more than half of the remedial students reported that they were financially independent. Lavin and Hyllegard (1996) cite low socioeconomic status as a common characteristic of developmental students.

A significant number of remedial students were first-generation students - the first in their family to attend college (Roueche & Roueche, 1999). Terenzini, Springer, Yaeger, Pascarella, and Nora (1996) studied 2,685 students who entered their first year of college in 23 diverse institutions in fall 1992. There were 825 first-generation students and 1,869 traditional students. First-generation students were more likely to come from low-income families, to have weaker cognitive skills, to have lower aspirations and be less involved with peers and teachers in high school. The overall description of a first-generation student was that of a student at-risk. Despite these characteristics, first-generation students were found to have better academic performance and persistence. York-Anderson and Bowman (1991) found that first-generation college students might find college more stressful and need more guidance since they had fewer experiences with college-related activities and role models.

The Developmental Studies Program in Tennessee

According to the PSTCC (2005) narrative written for the application for National Association for Developmental Education (NADE) certification,

> In 1983 the Educational EQuality Project of the College Board published *Academic Preparation for College: What Students Need to Know and Be Able to Do….* The College Board described six "basic academic competencies" (including… mathematics…) and the "basic academic subjects" (including … mathematics) identified by the Educational EQuality Project as necessary for success in

> college….In 1984, Tennessee's State Board of Regents published a White Paper entitled *Remediation and Developmental Studies: Developing a Plan to Educate Underprepared Post-Secondary Students in SBR Institutions.* The plan presented in the White Paper defined remedial instruction using the state's published "Objectives for the Tennessee Proficiency Test," given in high school. To define developmental-level coursework, the White Paper endorsed the competencies and curriculum of the College Board's Educational EQuality Project.…Two months after publishing the White Paper, the Board of Regents published the operational plan to implement the program of remedial and developmental instruction….The implementation plan required preliminary screening of applicants using ACT scores (or SAT equivalent) and high school transcripts, mandatory testing for students with deficiencies in academic areas, and mandatory placement based on diagnostic placement tests when required….In fall 1985, the first remedial/developmental courses were offered at Pellissippi State (p. 6-7).

In 2002, the state of Tennessee offered remedial and developmental course work at both the two-year colleges and four-year universities. Remedial mathematics

coursework was defined as basic computational arithmetic, and developmental mathematics coursework was defined as algebraic computations. An analysis of Tennessee Higher Education Commission (THEC) data revealed that the majority of remedial and developmental courses were taken by first-year freshmen. Remedial courses were less common among recent high school graduates than among those who had graduated a year or more before entering college. The proportion of first-time freshman taking any remedial and developmental classes declined from 55.7% fall 1992 to 49.4% fall 2000 (THEC, 2002a). The SREB (2006) report stated that 39% of first-time/full-time freshmen in Tennessee public colleges and universities in the fall 2005 enrolled in a remedial/developmental course. Separating the data reveals that 67% were attending community colleges and 25% were attending four-year institutions.

Developmental Students at PSTCC

At PSTCC, 17% of the 7,562-degree credit students enrolled fall 2004 were first-time freshmen. After assessment, 69% of the first-time freshmen were placed into developmental studies program (DSP) coursework. Of these 872 first-time freshmen who placed in DSP coursework, 69% were 18 to 20 years old (Office of Institutional Effectiveness, Research, and Planning, Focus Report, Table E).

The percentage of first-time freshman required to take a DSP course fall 2005 was slightly lower, 67.72%. By age, 72.34% of these students were between 18 and 20. The number of first-time freshmen required to take a DSPM course was 832 or 59.94%, with 69 % of the 832 students in the age range of 18 to 20 (S. J. Thomasson, personal communication, May 25, 2006).

In Tennessee, a score of at least 19 on the ACT Mathematics test allows a student to enroll in entry-level college mathematics courses. Nationally, 48% of high school seniors score below 19 on the ACT Mathematics test (Abraham & Creech, 2000). According to the State of Tennessee Statewide Report Card 2005, students in grades nine through twelve who took the ACT mathematics test scored 19.7 compared to 19.5 in 2004. These scores are based on a three-year average. The average ACT Composite score for 2004 was 20.3 and 20.5 for 2005 (http://www.k-12.state.tn.us/rptcrd05/state2.asp). For the 1,118 first-time freshmen at PSTCC in fall 2005 who declared a program of study out of a total of 1,388 freshmen, 40.88% had a ACT Composite score less than 19. Data for the ACT Mathematics test is not available for PSTCC students on the college website. (http://www.pstcc.edu/departments/institutional_research/enrollreports.php). The curriculum students take when they do not meet the standards for placement in college-level mathematics courses is described in the following section.

Developmental Mathematics Curriculum

The developmental mathematics curriculum is designed for students who are not ready for college-level mathematics, usually determined by the student's score on a placement test. College-level curriculum is usually defined as college algebra and beyond. Cohen (1993) states that developmental courses do not repeat high school courses; instead, the curriculum is built "around students' needs" for their college-level courses rather than "around their deficiencies" (p. 34). In addition, adult learners have time constraints, more focused career interests, and broader experiences than high school

students, which affect the developmental mathematics curriculum. He argues that placement in developmental mathematics should not be considered a punishment but an opportunity to learn the mathematics necessary to be successful in college-level courses. The reasons why recent high school graduates are not prepared for college-level mathematics are discussed in the following section.

High School Preparation for College-level Mathematics

Research

Most colleges offer a larger share of remedial mathematics courses than any other subject. One reason why students are unprepared for college-level mathematics is that many states do not require enough college-preparatory courses in mathematics for high school graduation. Tennessee is among many southern states that only require three math credits of Algebra I and higher. The neighboring states of Alabama and South Carolina require four mathematics credits (Algebra I and higher) for graduation from high school.

While the number of courses is important, the content and rigor is equally as important. Adelman (1998) suggests that working on the intensity of the mathematics curriculum and getting high school students to take a high school math course beyond Algebra II will decrease the number of remedial math students. Students who take more rigorous coursework in high school learn more and perform better on tests. Math students who complete a full college preparatory sequence perform much higher on the NAEP than those who complete only one or two courses (Haycock & Huang, 2001). Even though students successfully complete Geometry and Algebra II in high school, many place into remedial mathematics according to Hoyt and Sorenson (2001). Their study

confirms that the level of high school preparation and grades earned are significant predictors of placement in remedial math.

The students' failure to take a mathematics course their senior year of high school is cited by Abraham and Creech (2000) as another reason why students are not ready for college-level math. Even if high schools offer advanced math courses, students must take the courses and remain in the courses. Ma (1999) examined the effects of parental involvement on students' dropping out of advanced mathematics courses. The researcher found that there are two critical transition points when students drop out. One is from grade 8 to 9, and the other is from grade 11 to 12. The most serious drop is from grade 11 to 12 when approximately 36% of the students dropped out of advanced mathematics. He suggests that students entering their freshman year may encounter one or two types of segregation; students from lower socioeconomic backgrounds may be attending schools that offer fewer advanced math courses, or students are coming from schools that already tracked students into a certain academic program. Ma concludes by saying that an important strategy for reducing mathematics dropouts is to improve student's attitude in the later grades in high school. He believes that offering more relevant math curriculum is a way of achieving this.

Haycock and Huang (2001) and Boswell (2000) state that the tests that most states administer to high school graduates are not aligned with the tests used for college admissions or for placement into college-level courses. Haycock, Barth, Mitchell, & Wilkins (1999) calls this the "Algebra II gap" – the knowledge gained in this course is the "gateway to college-level work" (p. 26). Nationally available high school tests do not

cover any mathematics in Algebra II or above, whereas college placement tests have many Algebra II, Trigonometry, and Precalculus questions. This discrepancy can be disastrous for the student and confusing to the public as to what "knowing mathematics" really means.

Gandal and Vranek (2001) argue that state standards are not rigorous enough. In response to such allegations, Tennessee has implemented an "end of course" testing system called the Algebra I Gateway test. Students entering ninth grade during the 2001-2002 school year were required to be Proficient or Advanced on the Algebra 1 Gateway test to receive a diploma. An interesting dilemma occurred in 2005 with respect to the testing of eighth grade mathematics students in Tennessee. State tests given to eighth grade math students indicated that 87% of the students performed at or above the proficiency level. The results of the NAEP tests were quite different; only 21% of the eighth grade students were proficient in mathematics (Dillon, 2005).

Carter and Robinson (2002) reported on the Robinson Scholars Program, an early intervention and scholarship program for rural, Appalachian first-generation college students. This study described the issues of college preparation, cultural norms, and the transition to college for these students from low-income families. Data was gathered from surveys, focus groups, and interviews with high school juniors and college freshmen receiving Robinson scholarships. High school teachers described students selected for the program as having potential, but, in reality, the students were one to several years below grade level in science, mathematics, and communication skills. Low expectations and

grade inflation were cited as factors that often lead students to believe that they are prepared for college.

Research shows that good teaching improves student's achievement. Good teaching requires that teachers must know their subject matter and how to teach it (Haycock & Huang, 2001). The National Council of the Teachers of Mathematics (NCTM) has worked to improve the content and pedagogy of mathematics in grades K-12 by publishing Standards for School Mathematics in 1989, developing curriculum to support the standards, and revising the standards after reflection and feedback from teachers, mathematicians, and researchers. The Teaching Principle in the current Principles and Standards for School Mathematics (PSSM) states, "Effective teaching requires knowing and understanding mathematics, students as learners, and pedagogical strategies…. Such understanding might be characterized as 'profound understanding of fundamental mathematics'"(NCTM, 2000, p. 17). Ball (n.d.) states that typical methods for improving the quality of mathematics instruction include increasing the subject matter knowledge of teachers. Despite a decade of work on improving teacher quality, large numbers of secondary teachers do not have the equivalent of a college minor in their teaching field. The 2004 Tennessee State Report Card on Higher Education states that only "59% of secondary school students are taught by qualified teachers, which is only average compared with top performing states" (National Center for Public Policy and High Education, 2004, p. 5).

Teachers' attitudes and expectations are also a factor in improving student achievement. In 1998, more than 26,000 high school teachers in 12 Southern states were

surveyed. Over half the teachers felt that “helping students pursue a program of high school studies that will enable them to achieve their plans” and “helping students complete a program that prepares them for both employment and further learning” were “very important” schooling goals. In contrast, “developing students’ abilities to solve problems and think critically” was “very important” to 45.6% of the teachers, and “helping all high school students master the essential content taught in college-preparatory language arts, mathematics and science courses” was very important to only 38.6% of the teachers (National Commission on the High School Senior Year, 2001a, pp. 12-13).

Stevenson and Stigler (1992) compared the academic achievement of American students to their counterparts in Asian countries. They found that American students were weak in mathematical operations and how to use these operations to solve meaningful problems. They did not account this weakness to deficiencies in intellect. Asian students were more persistent and displayed more effort than American students in mathematical problem solving. Parents in the United States were much more likely than Japanese parents to believe that innate ability as opposed to effort was the reason for success in mathematics (Schoenfeld, 1992).

If Asian students achieve mathematically because of persistence and effort, what are other factors that influence achievement? Ma (2001) studied high school seniors in the Dominican Republic, and found that a feeling of enjoyment, not the feeling of difficulty, affected mathematics achievement. On the other hand, the feeling of difficulty is the most important factor in shaping the feeling of enjoyment. Ma stated that making

difficult mathematics content easy to learn does not improve achievement. Presenting mathematics content in an interesting, attractive, and enjoyable way improved mathematical achievement.

Students' beliefs also influence learning. Schommer, Calvert, Gariglietti, and Bajaj (1997) cite a study by Schoenfeld (1983) that found that "high school students who do poorly in math tend to believe that mathematical problems should be solved in 10 minutes or they will never be solved and that only geniuses are capable of discovering mathematics" (p. 37). Schommer et al. found that students who believe learning takes time and effort earn a higher grade point average.

Initiatives

Recent initiatives, referred to as P-16 or K-16, which are currently being discussed in educational circles would address many of the problems discussed in this section (Boswell, 2000; Cohen, Finn & Haycock, 2004; Haycock & Huang, 2001; National Commission of the High School Senior Year, 2001b). The P-16 system of education would encourage K-12 and postsecondary education to become one seamless avenue for all students. It would work together with the current NCLB program to remove the barriers that leave high school seniors behind. The historical tracking system that denies many high school seniors eligibility to higher education and viable jobs would be replaced with a system that prepares all students for college and the workplace (Haycock, at el., 1999). The high school exit exams would link with placement requirements for college-level courses making the standards for graduation and college placement comparable. This is extremely important since the Annual Joint Report on Pre-

Kindergarten through High Education in Tennessee (Tennessee State Board of Education & THEC, 2006) states that the "ACT results from 2005 indicate that only 16% of Tennessee students attained scores predicting a 75% chance of obtaining a C or higher on credit-bearing college courses in mathematics and science" (p. 3).

This approach is in its infancy; therefore, high school students are graduating without attaining the levels of proficiency necessary for college-level work. Also, many non-traditional aged students are returning to college as jobs and careers change, and new skills are needed.

Summary

Rural schools are closely tied to rural communities, and therefore suffer from the current economic changes effecting jobs in the Appalachian region. Poverty, out-migration of the educated youth, and loss of a tax-base impact the well-being and mental attitude of the school and the community. Many rural, high school graduates attend the local community college as a way to receive an affordable education, stay close to home, and acquire skills that will better their chance of earning a decent living in the area. These university-track graduates should be prepared by their local high school to succeed academically in college-level mathematics at the community college. Many fail to achieve the cut-off score on the state placement test for mathematics, and therefore place into remedial or developmental mathematics. The literature reveals that rural high schools experience problems that may lead to this lack of preparedness, such as teachers who are unqualified or required to teach more subjects than they can adequately prepare to teach, or the socio-economic status of the student. Other problems are more universal in

America, such as lack of persistence or effort by the student, and the disconnect between the expectations of high school and college. Rural educators argue that the positive influence of smallness of the school and close ties to family and community counteract the negative qualities, and a comparison of rural and non-rural students' achievement scores indicates that rural students generally do not operate from a deficit model.

Chapter III

THEORETICAL FRAMEWORK AND METHODOLOGY

Theoretical Framework

One of the aims of ACCLAIM is to understand the rural context as it pertains to the learning and teaching of mathematics (ACCLAIM, 2002). Howley, at el. (1996) claim that educators know little about the satisfaction level of talented rural youth with their own communities. Bush (2005) suggests that studies should consider what Appalachian community members believe and feel about mathematics as a school subject. Howley and Gunn (2003) state that qualitative researchers "have a better understanding of the importance of locale than many quantitative researchers." Most qualitative researchers are interested to discover and articulate the meanings attached to circumstance, places, and experience"(p. 94). Khattri, aat el. (1997) recommend qualitative analysis as opposed to studies based on national quantitative data. Burnell (2003) interviewed students for her study of work-bound, college-able, rural high school seniors and found that they were amazed that someone appreciated hearing about their lives and the decisions they faced. Roberts and Kay, Inc. (n.d.) used focus groups of randomly chosen middle and high school students to investigate "how …schools are doing and how they can be improved." (p. 1) Finally, Byrnes (2005), in his remarks to the governors' meeting of a national high school summit, recounts his finding from discussing and reading the accounts of recent high school graduates and implores the governors to "consider recent graduates' insights and perspectives"(p. 39).

Howley (2003) recommends a postpositivist approach to rural education research. Postpositivists believe that reality exists but can never be known completely.

Postpositivist researchers work to describe close approximations of reality while maintaining an objective position in relation to the experience that they are studying. Researchers see themselves as "data collection instruments, and they use disciplined research techniques… to ensure that empirical data, and not their impressions, drive their findings. Postpositivists are interested in capturing participant perspectives but in rigorously disciplined ways" (Hatch, 2002, p.14-15).

A qualitative approach serves this study because it answers the questions of "how" and "what." Qualitative research provides a well-grounded, rich description of the real-world situation being studied. The design strategy of qualitative research allows openness to adapting the questions as understandings change. The participants are picked because they are rich with information, not because of a prescriptive sampling technique. The researcher can get close to the people and the situation being studied. A quantitative study primarily looks for comparisons of groups or relationships between variables; a qualitative study allows for exploration of the participants in their natural setting (Creswell, 1998). Maxwell (1996) explains that "the strengths of qualitative research derive primarily from its inductive approach, its focus on specific situations or people, and its emphasis on words rather than numbers." (p. 17) In this study, participants tell their own stories. The purpose of inquiry in qualitative research, therefore, is to articulate a facet of the world "from the point of view of those who live in it."(Clark, n.d.)

Methodology

The participants for this research were community college students enrolled fall semester 2005 at PSTCC who graduated from a rural high school. These students were

traditional-age, high school graduates. Each student was placed in a college-level mathematics course (MATH) or a developmental mathematics course (DSPM) as a freshman. The students attended classes at one of the three campuses or one center of PSTCC. The students self-identified as rural, suburban, or urban.

I adopted Maxwell's (1996) terminology, purposeful sampling, to describe the "strategy in which particular settings, persons, or events are selected deliberately in order to provide important information that can't be gotten as well from other choices."(p. 70) To make sure that my conclusions represented the range of rural students, I decided on the following eight categories:

1. Male; DSPM; self-identify rural
2. Male; DSPM; self-identify non-rural
3. Male; MATH; self-identify rural
4. Male; MATH; self-identify non-rural
5. Female; DSPM; self-identify rural
6. Female; DSPM; self-identify non-rural
7. Female; MATH; self-identify rural
8. Female; MATH; self-identify non-rural

I began the process of locating students with these qualities with a survey (see Appendix A) given to all sections of developmental mathematics and college-level mathematics courses fall semester 2005. This was not my original method for identifying students who graduated from rural high schools, but since PSTCC was not able to provide me with this information, I decided that surveying mathematics classes was

appropriate. The survey was conducted during the last third of the semester. Students who were attending class at this time were more likely to complete the course. On the other hand, many students had already withdrawn or stopped coming to class. On the survey, the student indicated the name and location of the high school where he or she took high school mathematics, the student's age, gender, and the name of the math class in which the student was enrolled fall semester 2005. I also asked the student to identify him or herself as rural, suburban, or urban and whether the student was willing to be interviewed. If so, I asked for the student's name, telephone number and email address.

Copies of the survey were distributed to every instructor teaching a college-level or developmental math course including PSTCC web sections, but not the Regents Online Degree (RODP) sections. I sent an email to all instructors explaining my research and the process that I was using to find rural students. Surveys were returned to me in person or by campus mail. I determined that 1,540 surveys were returned from a possible 3,513 students (43.8%) registered at the beginning of the semester.

The first step in sorting was to remove the surveys of students who did not graduate from a rural school in East Tennessee, were younger than 18 or older than 24, or did not provide contact information. I then sorted the remaining surveys into one of the eight categories. I used the Student Information System (SIS) at PSTCC to determine if college-level students were placed in DSPM or college-level math as a freshman. Several students taking college-level math fall semester started in DSPM as a freshman. These students were considered DSPM. The numbers of available students at this point in the process are listed below:

1. Male; DSPM; self-identify rural 16

2. Male; DSPM; self-identify non-rural 18

3. Male; MATH; self-identify rural 12

4. Male; MATH; self-identify non-rural 16

5. Female; DSPM; self-identify rural 24

6. Female; DSPM; self-identify non-rural 22

7. Female; MATH; self-identify rural 10

8. Female; MATH; self-identify non-rural 19

I decided to focus on students who graduated from rural high schools located in the top-feeder counties to PSTCC. Of the 1,063 first-time freshmen from top feeder schools fall 2005, 165 students (15.5%) graduated from three of the rural high schools chosen for this study. (http://www.pstcc.edu/departments/institutional_research/ff_hs05f.php) I also intentionally included two K-12 schools, one located in a transitional county and the other in an at-risk county. The last three schools were picked because a large enough group of students had returned surveys to make it feasible to interview students who fit into several of the eight categories.

Descriptions of the Schools and Counties

As the geographical location of the high schools is an important element to my study as defined in Chapter 1, the following are brief descriptions of the schools and the counties where the high schools are located. All the high schools are classified as *rural*;

seven schools were classified as rural, inside CBSA. Only High School H, located in an at-risk county, was classified as rural, outside CBSA.

Schools Located in Transitional Counties

High Schools A and B are located in the same county, the most populated county in my study. The population of the county grew by 13.8% from 1990 to 2000. Two major interstates intersect in the valley between the Great Smoky Mountains to the southeast and the Cumberland Mountains to the northwest. Agriculture, industry, tourism, and education provide employment. There are twelve high schools in the consolidated city and county public school system; only two are classified rural. High school A, in the northwest part of the county, is located in a community described by the principal as being economically and ethnically diverse. The school's website describes the school's atmosphere as "unique. Students from diverse backgrounds attend classes in a hospitable environment where they can be comfortable with each other and their surroundings." School B, in the east part of the county, is described by the principal on the school website as a "comprehensive high school with an instructional program designed to meet the needs of the students…."

High School C is located in a county with one other county high school as well as two public city high schools. The county, located near the Great Smoky Mountains, is one of the oldest counties in Tennessee. The county seat is home to a small, private, church-related college. Thanks to a large plant built for the production of aluminum, the airport, and a national park, this county has thrived. More recently it has seen an increase in population of 23.1% from 1990 to 2000 due to a growth in industry and the numbers of

retirees. High School C is located 7 miles from the county seat, the largest town in the county, and affords a scenic view of the foothills of the Smoky Mountains.

School D has grades K-12 and is located in a small, rural community of 954 residents. This community, established during the 1800s as the result of railroad construction, is known as "primarily an agricultural community with strong civic pride." The community, in the southeastern part of the county, is about 23 miles from the county seat. It is situated within 10 miles of three Tennessee Valley Authority (TVA) lakes and, therefore, a popular retirement community. A website describes this community as being the place for families who "prefer simpler, less hectic lifestyles." The population of the county increased by 25.1% from 1990 to 2000.

Schools Located in At-risk Counties

School E has grades K-12 and is located in a small, rural community on the north side of the mountain range that divides the county. It is the most isolated of the communities under consideration.

High School F is located in a larger community on the south side of the mountain range in the same county as school E. This larger community is the county seat and was founded in 1798. The town has a population of about 2,500. The county is described on the Chamber of Commerce website as "the undiscovered gem of East Tennessee, bordered on the north and south with lakes and bisected in the middle by a mountain range. The county is a quilted patchwork of rolling farms and lush woodlands. The people are friendly, and the pace of life is slow and relaxed…. Agriculture produces the most revenue." Small businesses represent a second source of economic development.

Industrial growth has been marginal. Presently, almost half of the people in the county travel to surrounding towns for employment. The population of the county grew by 20.8% from 1990 to 2000.

High School G is located in a county described as a haven for nature lovers. A nearby TVA lake provides water sports and camping. The school is located in the largest town, which has a population of 1,782. With the building of the dam and the formation of the lake, the population and economic conditions have changed significantly. Large numbers of people left the farms. More recent times have brought limited industrial growth. Presently 85% of the work force commutes to jobs outside the county. The population of the county grew by 30.0% from 1990 to 2000, which is the largest increase of any of the counties under consideration.

High School H is a comprehensive high school located in the county seat, which has a population of 1,887. A larger town, 5 miles north, has a population of almost 8,000. Railroad development during the early 1900s transformed the economy from subsistence farming to coal mining and lumber production. The formation of the TVA lake and the building of the interstate provided a place and the means for tourists and retirees to come to the county. The county "offers a unique quality found in small communities. With a historic character, a temperate climate, friendly citizens, and a variety of recreational opportunities, this county is a proud community." Today, industries employ more than 25% of the county's workforce; tourism and the service industry employ more than half. The population of the county grew by 13.6% from 1990 to 2000, which was the least amount of increase of any of the counties in this study.

The information in Table 3 indicates that people living in the areas serving schools A through D tend to be better educated, have a higher income, and live in more expensive homes than those living in the communities served by schools E through H. Population age and ethnicity are very similar across all areas.

Information in Table 4 indicates that Schools A and B have a more diverse student body than the rest of the schools. Students in Schools E, F, and G are not as economically well off compared to students in all the other areas. Schools D through G have a higher graduation rate than Schools A through C. Schools A through D have a higher ACT Mathematics mean score.

I used the SIS at PSTCC to help build a more complete profile of each student. This system holds the student's high school transcript, which includes the math courses taken in high school, grades, high school GPA, and standardized test scores. After building all profiles, students were selected for interviewing whose profiles predicted rich data. I selected one student from a high school located in at-risk county who had completed a sequence of algebra through precalculus courses at her high school with a high GPA. She was a freshman at PSTCC and had already withdrawn from her college algebra course.

I purposefully selected three to five students in each category and used email to contact them; therefore, students who did not provide an email address were omitted. If I did not get a reply from a student in two to three days, I selected another student from the category to contact.

Table 3 Selected Descriptions of Location of High School based on 2000 Census

High School location by zip code	Population	Median age	% White	% of 25+/ Bachelor's Degree	% below poverty level	Median household income($)
A	18,203	35.8	95.2	30.8	6.2	45,314
B	8,487	36.8	97.1	7.4	11.2	35,378
C	21,966	37.6	95.5	15.4	10.2	35,482
D	4,241	38.5	97.1	11.6	9.7	39,487
E	2,563	36.2	98.6	4.9	20.0	26,300
F	7,123	39.2	98.1	9.9	17.0	27,163
G	9,517	35.4	98.5	5.5	20.3	27,200
H	8,970	36.3	98.2	9.3	16.3	31,219
Tennessee	5,689,283	35.9	80.2	19.6	13.5	36,360

Table 4 Selected Characteristics of High Schools Based on Report Card 2005

High School	Population	% White	% Economically disadvantaged	Graduation rate	ACT math mean score
A	1797	90.7	24.7	76.2	20.8
B	1011	85.6	35.9	77.7	19.5
C	1548	97.0	34.3	76.3	19
D	241	99.2	44.3	89.8	19.3 (2004)
E	184	98.9	60.7	80.1	17.8
F	883	98.5	53.1	83.4	18
G	1032	98.9	60.7	80.1	17.8
H	1353	99.3	45.7	80.6	17.4
Tennessee	5,689,283	69.9	52.12	77.9	19.7

Descriptions of Mathematics Departments and Course Offerings

Two high schools have websites with information about the mathematics departments and teachers. Information from the other six schools was requested via a telephone conversation and sent by either the head of the mathematics department, the guidance counselor, or school secretary. One mathematics department chair did not return the requested information, and the information obtained after the end of the school year was provided by the assistant principal and the one mathematics teacher teaching summer school.

High School A employed twelve mathematics teachers fall semester 2005, three males and nine females. Teachers generally taught three courses each. One teacher taught three classes and the ACT Prep class; another teacher only taught Honors Geometry and AP Calculus. The school website did not list other responsibilities these teachers may have had such as coaching or sponsoring a club. The mathematics courses offered were: Foundations I, Foundations IA, Foundations II/Algebra IT, Math for Technology II, Algebra I, Algebra I (Accelerated), Algebra II, Algebra II (Accelerated), Algebra II (Honors), Geometry, Geometry (Accelerated), Geometry (Honors), Calculus (College Prep). Precalculus was not on the list. A detailed description of each course was found on the school's website.

High School B employed nine mathematics teachers in the fall 2005, seven males and two females. One female, the head of the mathematics department, had taught twenty-one years at the high school and had an undergraduate degree in mathematics as well as a masters degree in curriculum and instruction. Six of the male teachers had other

responsibilities, including the school "gopher," basketball, soccer, tennis, and track coaches. Several teachers had undergraduate degrees in areas other than mathematics such as geology, industrial engineering, mechanical engineering, and education. Teachers generally taught two different courses a semester. Two teachers had taught at the high school more than 19 years; the remaining seven had each taught less than 10 years at this high school. The teachers who had only taught at the high school one and three years came to the school with teaching experience. Mathematics courses offered at the high school fall semester 2005 included Foundations I, II, Algebra I, II, Geometry, Advanced Algebra/Trigonometry, Precalculus, Calculus AB, and AP Statistics. Honors classes were also offered.

High School C employed 13 mathematics teachers in the fall 2005, teaching ten different mathematics courses, Special Topics in Arithmetic through Calculus. Four were females who had other responsibilities, such as department chair, faculty facilitator of the Youth Leadership for the county, and sponsor of the school's Big Brother/Big Sisters organization. The nine male teachers had other duties including head track coach, cross country coach, assistant boy's basketball coach, National Honor Society sponsor, junior varsity baseball coach, assistant principal, and assistant track coach. Four teachers had taught from 10 to 18.5 years at the high school. The remaining teachers had taught from less than one year to five years at the school. Five teachers had an educational specialist degree; three had a master of mathematics or science degree; and the remaining had only an undergraduate degree. All 13 teachers had, at most, two preparations in the fall semester 2005.

High School D, located in a K-12 school, employed three mathematics teachers during fall semester 2005, one female and two males who were described as returning retirees. The female teacher, who had responsibilities of chairing the mathematics department and coaching the girls' basketball team, taught Advanced Algebra I, Geometry, and Algebra II. She had a Bachelor of Science degree from Middle Tennessee State University (MTSU) and had taught at the school for ten years. One male taught Foundations I and II and was also the middle school girls' basketball coach. The second male taught calculus in the fall semester and advanced mathematics/trigonometry in the spring semester. He had the additional duties of athletic director. Both males held undergraduate, graduate, and educational specialist degrees from UTK, and each had taught at the school for 30 years. Mathematics courses offered at the school during fall semester were the following: Foundations I and II, Advanced Algebra I, Algebra II, Geometry, and Calculus.

High School E, also located in a K-12 school, employed three mathematics teachers during the fall semester 2005. The teacher who had only taught at the school for two years had undergraduate and graduate degrees plus 30 post-graduate hours at UTK. She taught three courses in the fall, Gateway Algebra, Foundations II, and Geometry, and was the advisor for the Beta Club. The male teacher, who had taught at the school eight years, also coached softball. He was deployed with the military in Iraq and did not teach in the fall 2005. He had taught Algebra II, Reading in the Content Area, Third and Fourth Grade Math Enrichment, Gateway Algebra, Geometry, and Algebra I. His undergraduate degree was in history with a mathematics add-on. The third teacher, a female, had an

undergraduate degree in physical education and had taught at the high school for four years. She taught Gateway Algebra through Advanced Mathematics and Trigonometry. The three mathematics courses offered in the fall 2005 were Gateway Algebra, Foundations II, and Geometry.

High School F employed seven mathematics teachers during the fall semester 2005. One teacher, a female, was terminated after one year, and the school is currently looking for a replacement teacher. The information given to me by the assistant principal via a telephone conversation was not as complete as the others, as the school year was over, the guidance counselor was not available, and the one mathematics teacher teaching summer school did not have time or feel comfortable giving me the requested information. I did find out that three of the seven teachers were coaches; two had taught at the high school for only five years; the remaining four had been at the school longer. The summer school teacher had taught 18 years and had experience teaching all the mathematics courses. He had a Masters in Business Education from UTK. The following courses are offered during the fall semester 2006: Competency in Mathematics, Foundations I, Algebra I, Algebra II, Geometry, and Precalculus.

High School G also employed seven mathematics teachers in the fall semester 2005, two males and five females. One male who taught Math Foundations I and II was also the football coach. The other male held degrees in education, administration, and supervision and taught Geometry, Algebra II, and Marketing. Only one female had undergraduate and graduate degrees in mathematics; she taught Geometry, Precalculus, and AP Calculus. Three females had undergraduate degrees in mathematics and graduate

degrees in English, Journalism, and Curriculum and Instruction. The teacher with the master's degree in English taught Algebra I, II, and Precalculus. Four teachers had taught at the high school for eight to 13 years; three teachers were hired more recently, teaching at the high school for one to two years. The mathematics classes offered, according to the school's website, were: Math Foundations I and II, Algebra I/Honors, Algebra II/Honors, Geometry/Honors, Precalculus/ Honors, and AP Calculus.

High School H utilized nine mathematics teachers, six males and three females, teaching ten different courses ranging from Foundations I through Calculus in the fall 2005. One teacher taught geometry exclusively; two teachers taught two different subjects; five teachers taught three different classes; and one teacher taught four, which included accounting. The chair of the mathematics department taught Precalculus and Calculus and had a Ph.D. from the University of Tennessee. Seven teachers had master degrees, and one indicated an undergraduate degree as his highest degree level. Only one teacher had additional coaching duties; another listed computer technology as another responsibility besides teaching. Two teachers had taught at the high school less than ten years; the rest have taught from ten to 31 years. Even though Algebra/Trigonometry was listed as a course taught in the fall 2005, none of the teachers listed it as a course they had taught that semester.

Descriptions of the Students Interviewed

Eighteen students were interviewed, ten females and eight males. Eleven of the students (61%) graduated from one of the four high schools located in transitional counties; seven students (39%) graduated from one of the four high schools located in an

at-risk county. All eighteen students completed the minimum requirement for high school graduation; the names used in the remainder of this discussion are fictitious. Only one student, Brad, did not complete the Algebra I, Algebra II, and Geometry sequence. He graduated from high school with a regular, technical path diploma completing only Algebra I and II. One student, Jerry, took Algebra I in the eighth grade at a middle school for credit. Laura said that she took Algebra I in the eighth grade but decided not to "test out," as she put it, and did not receive credit.

Twelve of the eighteen students provided information about the colleges they planned to attend while they were in high school. Greg and Mary considered attending the small, private college located in a neighboring town. Mary had the qualifications to be admitted to this selective college but changed her major and is taking college-level classes at PSTCC. Greg did not have the academic record to be accepted and placed into developmental classes at PSTCC. Four students planned to attend public universities in the region; three placed in college-level mathematics and one in developmental mathematics at PSTCC. Three students, who previously attended state universities, are now taking classes at PSTCC. One student who said that PSTCC was not his first choice planned to transfer to the local, public university. Luke was the only student who verbalized his need for a community college with small classes and developmental courses.

Ten of the students who graduated from high school in the spring 2005 met the Gateway Algebra I standardized test requirements according to information on their high school transcripts. The students' high school transcripts indicated that nine of the ten

students placed at either the Proficient (P) or Advanced (A) levels. The tenth student's transcript had the word "Met" written for the level. Five students placed in developmental math and five in college-level math. Six students were older and graduated from high school before the Gateway Algebra I test was a requirement for graduation.

Graduates from Schools Located in Transitional Counties

Table 5 lists the students who graduated from a high school located in a transitional county. Five of the eleven students (45%) self-identified *rural;* six (55%) self-identified *not rural* or *not sure*.

Eight of the eleven students (73%) took a lower-level mathematics course than Algebra I as a freshman in high school. Half of these made at least the minimum score of 19 on the ACT mathematics test and placed in college-level mathematics. The one exception was Rich, who entered PSTCC before the ACT Mathematics test was used as a placement test. Even though he made 19 on the ACT Mathematics test, another placement test was used, and he tested into the developmental intermediate algebra course. Four of the eleven students (36%) took a mathematics class during their senior year in high school; two of the four students had failed a math class and retook the failed class. Only one of the four students, Mary, placed in college-level mathematics. Even though she took Foundations II, she completed all of the college-preparatory mathematics courses offered at her K-12 school.

Table 5 Descriptions of Students Graduating from a High School in a Transitional County

Students by High School	Math classes	Failed a math course	Core GPA	Rank	Math senior year	Gateway Algebra I Level	ACT Math/ Placement
A							
Diane	Foundations II, Algebra I, II, Geometry	No	3.26	94/292	No	A	18,20/ MATH
Jim	Algebra I, II, Hrs Geometry, Precalc	No	3.21	NA	No	NA	26/ MATH
B							
Rich	Algebra I, II, Geometry	No	3.00	NA	No	NA	19/ DSPM
Luke	Foundations II, Algebra I, II, Geometry	Yes; Alg II	2.43	NA	Yes, retook Alg II	P	15,16, 15,16/ DSPM
C							
Kris	Foundations II, Algebra I, II, Geometry	No	3.36	61/307	No	A	16,17,19/ MATH
Laura	Foundations II, Algebra I, II, Geometry	Yes; Geom	3.17		Yes, retook Geom	NA	16, 16/ DSPM
Curt	Foundations II, Hrs Algebra I, II, & Geometry	No	2.93	NA	No	NA	23/ MATH
Greg	Foundations I, II, Algebra I, II, Geometry	No	3.00	140/307	Yes	Met	17/ DSPM
Jerry	Alg I (8^{th} gr), II, Adv Geom, Prob & Stat	No	3.39	61/264	No	NA	24/ MATH
D							
Brad	Comp Math I, Foundations I, II, Algebra I, II	Yes; Alg II	1.90	43/58	No	P	15,14/ DSPM
Mary	Foundations II, Alg I, II, Geometry Adv.Alg/Trig, Calc, Statistics	No	3.71	9/55	Yes	P	18,23/ MATH

Eight of the eleven students (73%) had a high school core GPA of at least 3.0 out of 4.0. Five of the eight (62.5%) placed in college-level mathematics. Only one male student, Curt, with a GPA below 3.0 placed in college-level math; the other two students with a GPA below 3.0 placed in DSPM. Three of the eight students (37.5%) with a GPA above 3.0 placed in DSPM. Gateway Algebra I test scores were not available for the students who graduated from high school before spring 2005. Also, high schools report the scores differently on the transcripts. Greg's transcript indicated that he had only "met" the required level. Five students had either an Advanced (A) or Proficient (P) level score. Both students with an Advanced level score placed in college-level mathematics. Only one student with a Proficient or Met score placed at the college-level.

Table 5 shows different academic paths of two students, Brad and Mary, at School D. Both students have fathers who attended college, and both took several high school mathematics classes. Brad had a poor academic record in high school, graduating with a low GPA and class rank. Three of the mathematics courses he took were below the Algebra I level. In contrast, Mary graduated with a high GPA and class rank and completed three mathematics classes above the Algebra II level. She told me that during high school she had planned to attend a small, private college located in the neighboring county, which has selective admission guidelines.

Graduates from Schools Located in At-risk Counties

Table 6 lists the students who graduated from a high school located in an at-risk county. Five of the seven students (71.4%) self-identified rural; two (28.6%) self-identified *not rural* or *not sure.* Only one student took the Foundations/Algebra I

Table 6 Descriptions of Students Graduating from a High School in an At-risk County

Students by High School	Math classes	Failed a math course	Core GPA	Rank	Math senior year	Gateway Algebra I Level	ACT Math Score/ Math Placement
E							
Missy	Algebra I, II, Geometry	No	3.25	10/49	No	NA	16, 16, 15/ DSPM
F							
Meg	Algebra I, II, Geometry, Precalculus	Yes; Alg II	2.63	79/142	No	NA	16/ DSPM
Melanie	Algebra I, II, Geometry, Precalculus	No	3.00	52/142	No	A	17/ DSPM
G							
Charity	Algebra I, II, Geometry, Adv. Math	No	NA	11/180	Yes	NA	16/ MATH at university
Jenny	Algebra I, II, Geometry	No	3.62	23/170	No math jr/sr years	P	20/ MATH
Joe	Foundations 1, 2, Algebra I, II, Hrs Geometry	No	3.50	36/195	No	P	17/ DSPM
H							
Cherie	Algebra I, II, Geometry, Precalculus	No	3.93	18/254	No	A	17, 19/ MATH

sequence even though all four of the schools offered Foundations II during one of the semesters. Six of the seven students (86%) did not take a mathematics class during their senior year. Jenny who did not have a mathematics class in either her junior or senior years of high school placed in college-level mathematics. Charity did take math her senior year but did not take a math class her junior year. Even though three students took Precalculus, two placed in DSPM. One student took a course after Algebra II, which she called Advanced Mathematics. Despite graduating from high school with a 16 on the ACT Mathematics test, she enrolled in College Algebra at the local university. She failed College Algebra and placed in DSPM at PSTCC. Four students met the Gateway Algebra I test requirement to graduate from high school; two of the four (50%) placed in DSPM. This includes one of the students who scored at the Advanced level.

Analysis of Interviews

The initial interview lasted approximately 45 minutes. Each student was alerted to the possibility of a follow-up interview. A conversation with the student was based on open-ended questions (see Appendix B). I interviewed students in a conference room or other suitable facility on the campus where the student attends class. The purpose for the interview was summarized, and the student was requested to sign the consent to interview and confidentiality statement (see Appendix C). I explained to the student that I needed to tape record our conversation. I had a copy of the questions, and as each students talked Imade notes on the copy of any impressions or follow-up questions I had that I did not want to forget to ask. I gave each student a $15 gift certificate to the PSTCC bookstore after the interview. A paid transcriptionist transcribed the interviews. The transcriptionist

had worked at PSTCC for several years, most recently as secretary of the math department. She had transcribed three interviews that I had with rural, community college students during the spring semester 2005 for a pilot study.

I listened to the recording of each interview after it was transcribed. As I read through the transcription, I compared my notes to the recording and made corrections to the transcription. I then read through the interview looking for "segments of texts where the student made comments on specific topics." I adopted the terminology "frames of analysis" used by Hatch to describe these "analyzable parts" (p. 163). I delineated these parts with a yellow highlighter.

Next, I made a list of the nine semantic relationships (see Appendix D) identified by Spradley (1979). The first and most common is strict inclusion, which is represented as X is a kind of Y. Second is spatial; X is in place of Y. The third relationship is cause and effect; fourth is rationale; fifth is location for action; sixth is function; seventh is means-end; eighth is sequence; and ninth is attribution (Hatch, 2002). I started with a more obvious domain and cover term – reasons why students self-identified rural – and used the worksheet (see Appendix E) to write down the included terms as I read through the transcript. According to Hatch, "included terms name the members of the category and a cover term names the category into which all the included terms fit" (p. 165). As I read, I discovered more domains and included terms, which I listed on a separate sheet of paper. I wrote down each domain and cover term from the list on a separate worksheet and reread the transcript, looking for all the included terms for each. As I interviewed more students and received each transcription, I repeated this process.

As I read more transcripts, salient domains emerged, and I assigned each a code. Several domains were not used. I made a rough outline of the salient domains and the included terms, and then I reread the data and marked excerpts that supported or did not support the relationship. I searched for themes across the domains by constantly comparing domains. I revised the outline several times before creating a master outline (see Appendix F), which states the relationships within and among domains. From the outline, I wrote a rough draft of my findings.

To enhance reliability and validity of my study, I met frequently during the fall semester with a member of my dissertation committee to discuss my methods for analysis, findings, and documentation. I maintained a paper trail of decisions that I made during the collection and analysis of the data.

Next, I identified domains in my findings that needed additional support or clarification. I reread the student interviews to decide which students to approach for a follow-up interview and what questions to ask to clarify or add support to the domains. I decided to contact nine students who could potentially provide more data. I sent individual emails to each student to set up a time and place for an interview, or, if this was not possible, to ask the student to respond to my questions using email. Seven students responded to my email, and one, Cherie, came for a face-to-face interview. I gave her a $10 gift certificate to a local department store. The other students preferred to answer my follow-up questions using email. I transcribed the interview with Cherie and used her answers as well as the answers provided by the other six students to clarify and add to my data.

After collecting this additional data, I wanted to thoroughly analyze the data by rereading the original eighteen interviews, the transcription of the one follow-up interview, and answers to my follow-up email questions. I identified phrases, sentences, or paragraphs that supported the major and minor headings in the outline and coded them using Roman numerals, letters, and numbers. I used these codes to compare findings in my rough draft and to fill in any missing information. As I read, I selected quotes to support my findings.

Chapter IV

FINDINGS

This study explored mathematics education from the perspective of rural, community college students at Pellissippi State Technical Community College (PSTCC). The purpose of this study was to investigate the following questions:

1. What are the students' perceptions of growing up rural?
2. What are the students' perceptions of their rural, high school mathematics experience?
3. What are the students' perceptions of the factors that contributed to their preparedness or lack of preparedness to take college-level mathematics?
4. What are the students' perceptions of the effect that growing up rural had on their high school mathematics experience and their preparedness for college-level mathematics?

The findings of this study are reported under the following headings which emerged as salient themes from the data: rural identification, factors that influence the students' perceptions of rural, growing up rural, high school mathematics, preparation for college-level mathematics, and rural influence.

Themes

Rural Identification

The students interviewed graduated from a rural high school as designated by the NCES. Despite the rural nature of the school, I found that the student may or may not think of him or herself as *rural*. A question on the survey asked the student to indicate whether the student considered him or herself rural, suburban, or urban. This

identification was discussed during the interview. The reasons given by students for determining their rural or non-rural identification were based on the physical characteristics, the economic conditions, and the social nature of the communities where they lived or grew up.

Ten students self-identified *rural.* Reasons given by the students for identifying rural included the following descriptions of the locale where the student lived: on a farm, near the mountains, or in a small town. Several students experienced wide-open spaces, the stars at night, and clean air. Other students described their community as isolated, poor, neglected, and lacking in social and work opportunities. Melanie surmised that people living in her community were isolated since "more than 40% have never driven on the interstate.…" Joe, aware of the poverty, stated, "… in rural areas you see more of your poorer people than the wealthy." Missy said, "… There's nothing there, nothing. The only thing we have is the post office, a bank, and a couple of little stores. That's it…." Brad expressed his disdain for his rural community by calling it "Hickville."

Students who self-identified *rural* also described limited job opportunities. A few agricultural jobs such as cutting tobacco and growing tomatoes were mentioned, but few students had first-hand knowledge of these types of farming activities. Only Meg admitted that she had experience working in the fields when she said, " I used to work in tobacco when I was younger with my papaw." Manufacturing jobs were available, but for the most part older family members found work in urban and suburban areas located within driving distance of their homes.

Social activities revolved around school and church; otherwise there were few social opportunities available in the immediate area. Everybody knew everybody and gossip was shared freely in the close-knit communities. Many people had the same last names and claimed a family relationship. Being known in the community could be helpful in certain situations. Missy remembered, "One [student] got pulled over, and his dad was a tomato farmer producer. I'm pretty sure he got out of the ticket. He was going like 120, so that just shows …" The students recognized that members of the community were friendly and were proud that their community had strong values and morals. Joe said:

> … living in a rural area makes you – it makes me more down to earth, and I know where I come from, and I'm proud of where I come from. I'm not, you know, I don't tell people I'm ashamed or anything, but I don't know; it seems to me that more people from rural areas are friendlier sometimes than other places.

The six students who self-identified *not rural* described their home as part of a subdivision or suburban area. These students differentiated where they lived from where they went to school. Laura was rather eloquent about the differences:

> I live in what they technically call the city, and my high school was straight country, surrounded by mountains. I can see the mountains, but I can see the airplanes more. So I think that's the big difference – is I can see more. When I

> turn off my lights at night, there are streetlights surrounding me. But when I went down to the high school late at night, doing extracurricular activities, there was nothing but the moon and the stars.

Another confusing or misleading factor was poverty; students who were not poor did not think of themselves as rural. One student characterized rural people as less educated, and he was not; therefore, he did not self-identify *rural*. Jenny said that she liked to be with people and having her friends around; therefore, she did not self-identify *rural*. But Jenny said this about her community: "everybody was related, and you had to watch what you'd say about everybody because… they've got 25 cousins to back them." Laura said that she was *not rural* since she was not the country-type; she did not live on a farm; in fact, she had never been to a farm. But she did recognize that her family emphasized stronger values and morals, which she attributed to the larger, rural area where she lived and went to school.

Two students were classified *not sure* because they did not know the definition of rural and guessed or were confused about their self-identification. Curt erroneously equated rural with living in the city. Other students interviewed from his high school located in a transitional county were split on their self-identification. Melanie equated rural with underclass and poor; she was neither, so she did not self-identify *rural*. She characterized rural people as really isolated and the families as "really weird – just too close." Another student from her high school located in an at-risk county identified *rural*.

Factors that Influence the Students' Perception of Rural

I separated the 18 students into two groups: those who self-identified *rural* (Table 7), and those who did *not self-identify rural* or were *not sure* (Table 8). I identified key words or phrases that the student used to describe his or her perceptions of rural. Descriptors that I considered were the gender of the student, the student's placement in either developmental or college-level mathematics, and the economic status of the county where the high school was located.

Students who Self-Identified Rural

Of the ten students who self-identified rural, six were females and four were males. Two females from transitional counties were prepared for college-level math and perceived rural using the typical language of country and farms. Three females from at-risk counties who placed in DSPM described rural as being neglected, poor areas or areas with limited social and work options. Another female from an at-risk county who placed in college-level math also described rural as being secluded with few options.

Of the four males, three placed in DSPM, and only one of these described his rural home using the economic characteristic of poor. He was the only male who graduated from a high school located in an at-risk county. The three males from transitional counties used the more generic descriptions of rural as country, farmland, or small town.

Table 7 Students who Self-identified Rural

Name	School	Placement	County	Perceptions of rural
Female				
Diane	A	MATH	Transitional	Country, far out from city
Mary	D	MATH	Transitional	Farmland, small towns
Missy	E	DSPM	At-risk	Isolated, neglected, poor
Meg	F	DSPM	At-risk	Farm in the boonies; nothing to do
Charity	G	DSPM[1]	At-risk	Small town, lacking opportunities
Cherie	H	MATH	At-risk	Secluded, no options
Male				
Greg	C	DSPM	Transitional	Farm field with few neighbors
Jerry	C	MATH	Transitional	Country, clean air, farms; strong family ties; slower pace
Brad	D	DSPM	Transitional	Out in the country; privacy
Joe	G	DSPM	At-risk	Small town; poor

[1]Charity's ACT MATH score would currently place her in DSPM. At the time of her high school graduation, she was able to take college-level math at the university and later at a neighboring community college.

Table 8 Students who Self-identified Non rural or Not sure

Name	School	Placement	County	Description of rural
Female				
Laura	C	DSPM	Transitional	Farms, stronger values
Kris	C	MATH	Transitional	Country, mountains
Melanie	F	DSPM	At-risk	Small, family oriented community; underclass people
Jenny	G	MATH	At-risk	Not many people; isolated
Male				
Jim	A	MATH	Transitional	Open fields, farms, cattle
Luke	B	DSPM	Transitional	Not many people
Rich	B	MATH[1]	Transitional	Country; less educated
Curt	C	MATH	Transitional	Maybe in the city

[1]Rich's ACT MATH score would currently place him in MATH. At the time of his graduation from high school, a different placement test placed him in DSPM.

Students who Self-Identified Non-Rural or Not sure

Eight students classified as *not rural* or *not sure* about their self-identification or did not know the definition of rural. Only one of the four female students, Melanie, who placed in DSPM and lived in an at-risk county, used negative language. She equated rural with underclass people, and since she was not poor, she did not consider herself *rural*. Jenny, also from an at-risk county, equated rural with people who preferred to live in isolation. She likes being around people, so she did not identify herself as rural.

All of the four male students graduated from high schools located in transitional counties. Only Rich described rural people as "less educated", which left him "feeling bad." Rich made 19 on the ACT Mathematics test, but at the time of his graduation from high school, a different criterion was used to place him in DSPM. Curt admitted that he guessed about his self-identification. When I questioned him about the location of his rural high school, he thought that his high school was "in the city."

The location of the high school seemed to determine the students' self-identifications and the students' perceptions of rural. Of the ten students who self-identified *rural*, five attended high schools located in at-risk counties. Of the eight who did not identify themselves as *rural*, only two were from at-risk counties. In terms of the location of the high school, eleven of the students interviewed graduated from one of the four high schools located in transitional counties: five self-identified *rural*, five *not rural*, and one *not sure*. Seven students graduated from one of the four high schools located in at-risk counties: five identified *rural*, one *not rural*, and one *not sure*. These numbers

suggest that students from at-risk counties are more likely to identify *rural*, and students from transitional counties are more likely to identify *not rural*.

The strongest relationship appears to occur between the students who graduated from an at-risk county and perceptions of rural areas as neglected, poor, or lacking options. Perceptions do not seem to be related to the gender of the student or the placement of the student in either DSPM or MATH.

Since the location of the high school influenced the students' perceptions of rural, I compared students' perceptions in the remaining sections of this chapter using the two categories, *transitional* and *at-risk*, determined by the economic status of the county where the student attended high school.

Growing Up Rural

The themes that emerged from the data describing the lives of students growing up in rural communities were the following: descriptions of schools, teachers, and related activities; planning for college; and characteristics of the community. For schools and teachers, I described the following areas: methods of transportation to and from school, size and diversity of the school, sport and social activities, relationships of students with teachers and administrators, and discipline. For college plans, I discussed the rigor and challenge of high school courses, the support from guidance counselors and teachers, and the influence of parents, family, and the local community. Last, I described the student's perceptions of the economic status of the community and opportunities for employment.

There are similarities and differences between students who grew up in at-risk counties compared to those who grew up in transitional counties. Similarities that

surfaced from the data are the following: students rode to and from school with friends or relatives and eventually drove when possible; students knew teachers and administrators; the student population at the school was primarily white with diversity in social groups rather than across racial or ethnic lines; students' parents, extended family, and friends were instrumental in encouraging students to make plans for college; and the student's peer group mirrored the student's academic pursuits. Differences occurred in the following areas: the economic status of community and school which affected the purchase and maintenance of school equipment, students had fewer options for courses and teachers, the availability of sports and social activities and availability of after school jobs or employment after graduation, teacher relationships with students, classroom discipline, the rigor and challenge of college-preparatory coursework, the support from guidance counselors, and the family's experience with college attendance.

Students from At-risk Counties

Students who graduated from high schools located in at-risk counties described growing up rural in the following ways: most students rode the bus to and from school through the ninth grade. Students who attended county high schools described the bus rides as lasting forty-five minutes to an hour. Students who attended the two smaller schools in the same county lived closer to the school, and therefore, the bus ride was not as far. As soon as older siblings or friends obtained their driving permits, the student would no longer ride the bus. For several students, turning 16 and obtaining a driver's permit meant the family car became available. As one student pointed out, the people in her county were not wealthy, and it was not the norm for students to get a new car on

their sixteenth birthdays. On the other hand, Cherie, who graduated from a county high school, said that more kids rode the bus than drove. She recalled that some of the younger students in high school had hardship licenses, which allowed them to drive from school to an afternoon job. Charity rode the bus through high school because she had few neighbors, and none of her friends lived close to her home to give her a ride. Jenny was not allowed to drive until she was 18, so she was one of the older students riding the bus to her county high school.

These students attended smaller schools compared to the size of the comprehensive county schools in more suburban areas. Missy who attended high school E located in a K-12 school said that she took the only "[class] that was available, which I didn't get to sign up for classes – they signed you up for them. That's all that was available and that's what you got." The other school in the county was also small compared to the two high schools located in adjacent counties. The students felt that the size of the school limited the number of course offerings and the choice of teachers for each class. One student characterized the class size as small. Since the classes and schools were small, "everybody knew everybody – everybody knew everybody's business."

Because of this closeness, there were some discipline problems. Cherie admitted:

> I guess the discipline probably wasn't very good – a lot of school fights, obviously – the school atmosphere, as a whole. Everybody knows everybody, but that's also how all this stuff can get started because oh, you were with my

> boyfriend, or you said something about my sister, or you know everybody hears other things, and it's a lot more drama, I guess. Everybody knows everything about your life.

On the other hand, Melanie said, "Kids were well behaved." Jenny remembers two fights in her Algebra I class. She said, "It was one older student picking on a younger student, and then another time I think it was the same kid. It was a pretty bad fight, too." She took Algebra I as a freshman and had older students in the class. She thought that altercations in one class carried over to the next class since many students had the same class schedule.

When I asked about diversity, several students talked about the cliques in their schools. Melanie described the cliques as "the gangsters and then the drug dealers and then preppy over here and then just like the average over here. So, there were like four of them. And then the jocks – there's the jocks – there's five of them." Cherie labeled the cliques "the rednecks, …your skaters, …your gothic kids, …your preppy kids, and Hispanics…unfortunately there's a lot of stereotyping." Regarding ethnic diversity, there was very little. Joe alleged, "It was mainly an all-white school. We had maybe one African American student, and we had one or two Hispanics, and I think we had one Israeli." Students also point out that many people in their communities had the same last names and used that as an example of the lack of diversity in the school. Melanie said, "It seems like everyone is related up there."

All the high schools except the high school E located in the K-12 school had a football team. Missy said, “Our school wasn’t big enough to have a football team…. They played softball and basketball.” Missy said that not many students participated in the School Spirit Week activities. Meg said that her senior section for spirit week was small due to students dropping out of school. When asked why students dropped out, she explained that the students were either pregnant or on drugs. She went on to say that it was easy to get into trouble in her rural community because there was nothing to do. Because of the size of these rural schools, students, administrators, and teachers knew each other. And because of this familiarity, students “knew how to talk to [teachers] and you knew what to say and what not to say.” As one student said, “Teachers would get involved in everything.” The students cited close relationships with teachers. Many teachers grew up in the community, graduated from the same high school where they now teach, and live in the same community. Several students’ parents had the same teachers when they attended the high school. On the other hand, Joe said that he did not see all of his math teachers in the community; two lived in a neighboring state and town. Teachers who came from out-of-state were likely to be harassed by the students. Missy said,

> … I don’t think many people got respect. Like that one teacher I was telling you that came from… – I am so glad that she stuck in there, and there was another English teacher. She was great, but she left because of the harassment. People got angry; I guess because they were

> being taught, and they weren't understanding and that would make them mad at themselves, and they would take it out on the teacher.

Meg described her school this way: "I had pretty good teachers, and then I had some really rotten teachers. The school was based on favoritism. They were really, really bad about that and there have been so many people's parents come up there." Other students told of instances where teachers showed favoritism toward athletes. Charity said, "In the class … there was some basketball players or something – he [said], "I'm not going to show you where the answers to the test is on my desk, but you can go find them." Melanie felt that you "got treated better if you have the same last name [as the teacher]." Meg suspected "that if the teacher knew your parents you got favoritism."

Some of the students were told during high school by older friends who had gone to college that their high school education was not rigorous or challenging. Once the students attended a college class, they understood what their friends had tried to tell them. Missy speaks for the rest of the students:

> They're getting away with teaching students the minimum…I feel cheated out of my education. I mean not just in math, but you know in most areas, and I know that if I didn't try to make myself study that I wouldn't be here today…it's not because I didn't try to learn; it's just because that's all I was taught.

Jenny said it this way: “teachers teach in a way that they think that most kids [at the school] are stupid…they don’t go into depth on anything…Read the paragraph and answer the questions at the end, for everything.” Cherie’s cousin attended a high school in a neighboring county, and Cherie compared what her cousin told her to her own experience: “She tells me about the courses she takes and the homework …she has so many hours of homework a day, you know this, that and the other. To me, that’s just like a foreign language because I’ve not been used to any of this.”

The students said that they always knew they were going to college. Even though the students perceived that a majority of the students in their graduating class were on a vocational or technical path, these students along with their high school friends were college bound.

The students talked about their experiences with guidance counselors. Even at the smallest high school, there were at least two counselors. Meg characterized her two counselors she had this way: “The counselor my junior year, she sucked. The one before that was really, really nice. She helped some people.” Melanie remembered that her guidance counselor “didn’t have any time,” and if she went to her “she’d blow us off….She helped fill out the FAFSA and that’s about it.” Jenny found scholarships at the local community college on her own and felt that “the guidance office could have been more helpful.” She remembered that several scholarships were found online, and that “half the kids there didn’t know how to use the computer.”

Only one student, Cherie, talked about a great experience with the guidance counselors. Her high school set up a system where a guidance counselor was assigned

the freshman class, learned the names of all the students, and worked with the class through all four years of high school. Cherie found this effective and was positive about her experience with the guidance counselor.

Parents of these students did not attend college, but most were urging their students to seek higher education as a way to increase their opportunities for better jobs. Missy said her parents "always taught me to do better." None of the students mentioned any negative feelings from their parents, families, or communities about attending college. Charity said this:

> It was. It was more like, "If you go, we're proud of you, but if you don't, same thing."…It's not really. It was never an issue because my grandparents – now my cousin's mother, she also wanted to go to college so yeah, she sees it as a big thing. My mom always told me I needed to get my education because of the struggles she's had. She's like, "You have to have your education to make it." …

Joe chose to live at home and attend the community college rather than live on campus at the university because of "family and church." Joe and Jenny graduated from the same high school and realized that many of their fellow students did not get the same push to go to college to increase their employment opportunities. Jenny said, "The parental support, I don't think is as good as it could be. Cause my mom, it was always, 'You're

going to college, you need to do, try your hardest.' But a lot of the kids don't. They go to school, half of them miss and go to court for truancy."

Students described limited job opportunities while they were in high school and when they chose to stay in the community after graduation. When I asked Meg about jobs in her town, she said :

> …there is a Pizza Hut, which it didn't get there until about four years ago. So basically, the only thing that's really been there my whole life is a …. which is a restaurant, an IGA, and a gas station, and that's it….We've got a Family Dollar now. There's been stuff added like in the past five years but as far as being there more than ten years….

There were agricultural jobs in growing tobacco and tomatoes, although one student said the farms have become subdivisions or places to raise horses. One student described the "rednecks" as the students living on the farms. At another school, it was the "rednecks" who took the vocational classes. Joe described drugs as being bad in his county and said that he knew "a lot of people who are into drugs." Most students' parents drove outside their respective county to work. Most students' close friends were also in college; few students told me about friends who stayed in the community to work after high school. The students realized that if they chose to live in the community where they went to high school, then they should plan to drive some distance to their workplace.

Several students were very aware that their county had more poor people than wealthy. One student observed that no one from the outside seemed to care or want to

come in and make changes. The students realized that the poverty of the county affected the quality of their education. Meg stated, "Our school was poor, just poor as can be; it's awful. Our driving unit, it's broke. We just sit there and pretend and it was donated to us."

The students talked about the close relationships that people had within their community. People were characterized as being nicer in their community; another student said that there was a split between good and bad people. Missy described her rural community as peaceful and said that it was a "good place for a vacation, but not to live." On the other hand, not a lot of "bad stuff happens" in her community and "people respect each other more." Melanie was the only student who mentioned that rural communities "don't like change…So if you change it then they're mad." Although Joe was not ashamed of his rural community and liked the friendliness of the people, he said this about sending his own kids to the high school where he graduated: "I'm thinking about going to a [suburban county] to send my kids to school because I'm not very happy."

Students from Transitional Counties

Students who graduated from high schools located in the more affluent counties labeled transitional characterized growing up rural differently from students who graduates from high schools located in at-risk counties. Much less was said by these students about riding the bus. Most students rode the bus through the ninth grade and then carpooled with neighbors, friends, or relatives. Kris was always a car rider before she drove. Rich "got a car when I was 16 and took off. I drove myself and my brother to

school" even though the bus stopped right down the street. Kris rode the bus maybe "three times [her] freshman year. I was embarrassed." On the other hand, Laura preferred a "nice, long bus ride to school where I can get ready and look good." Jerry said a lot of students who lived further out from school rode the bus because it was the only way to get home. Greg was the only student that mentioned a school rule that prohibited a student from driving if the student was failing a grade.

Students had differing opinions over the size of their high school. Jim, who graduated from the largest of the high schools, remembered that the school population had increased after rezoning. Diane, from the same school, realized that the school was big enough for new students to "lose themselves in the school."

One the other hand, Kris said this about her high school:

> … is really small, so everybody knows everybody, and all the teachers know all of the kids, so it was a big shock going to college and not knowing one person in any of your classes, but it was small, and I liked that, and it was very easy to get around. It was nice. I liked it – it was small.

Greg who graduated from the same school had a different frame of reference. He said, "It was class 5-A in football, which is the highest class. I believe they said we had 1,700 kids that went there. So it was a big high school, and it was over-crowded. So I had 35 people in my class – in every one of my classes." Even though Greg considered his high school big, he said that he saw his teachers out in the community, and they would call him by name.

One of the high schools was located in a K-12 school and was the smallest of the schools located in transitional counties. Mary described her school this way:

> It's a small school, basically, like you don't have a lot of choices as to what classes you take. Everyone takes the same classes – there's not honors or anything like that. But I mean, they do have like trig and calculus, you know. So if you go to the upper-level math, I took seven math classes in high school, which is not required.…I liked that it was a smaller school because I felt like there was more personal attention….

Mary said everyone at this school took the university path because the vocational path was located at a different school. Some agricultural and shop classes were offered, but a student could not do a complete vocational path. Even students in the larger county high school had scheduling problems; Curt could not take a certain mathematics course because it conflicted with his honors English II class. Despite the actual size of the school, all the high schools were small enough that "if something happened, then everybody knew about it. If you made a bad grade, then everybody knew about it. Or if something bad happened, everybody knew about it. So, just as it was great that everybody knew everybody, it was bad that everybody knows everything about everybody."

These students experienced more diversity in their schools compared to schools in at-risk counties. One student at a county high school attributed the increased diversity to

a rezoning of the lines delineating assigned schools. At the same school, Diane said the school "wasn't very accepting to new people especially if they were of a different race or religion." At a different school in the same county, Luke said that "there's really good diversity of the students…we had a majority of whites; there were no blacks there." Mary described diversity at the K-12 school as one mixed race student, one Jewish student, and a teacher from the north. She said that her school was "very judgmental as far as you're not like me. They're all like that – you're not like me so if teachers came that were different they wouldn't stay very long because you wouldn't see it at school, but you know they were very judgmental." This school "had …groups…but it wasn't like there were cliques…" At a larger school, Laura said, "We didn't really have cliques – we were all friends with each other because we grew up together. I didn't meet a lot of ghetto gangsters… or preppy kids. I met a lot of good boys and girls who were very strong in their beliefs, and they had a good work ethic."

At all the schools, football was the big social event. Perhaps more so at the K-12 school where Mary said "it was a way of life." She remembered that eighth graders were allowed to play football, and many of the middle school-aged students participated in the social activities surrounding football.

Similar to the students from at-risk counties, these students described the close relationships they had with teachers. Diane even babysat for one of her teacher's children. Diane had a death in her immediate family while she was in high school, and she talked about the outpouring of sympathy from classmates, teachers, and administration. Luke was very complimentary of the teachers and administration at his

school. In particular, he singled out the principal who “did her job well, handled things very professionally, and didn’t care if she was popular or not.”

Discipline was “very good” according to Greg. “They didn’t really have trouble out of anybody….Nobody ever wanted to disrupt [math] class.” Mary was the only one who described pinching and fighting between girls at her small high school. Curt said that “most of the classes behaved themselves, but sometimes with coaches…they would joke around.” Jim remembers that his Algebra I class would “get out of hand pretty often” and the teacher would “raise her voice and try to keep us quiet.”

Kris described the students at his high school as “not as smart” compared to students attending other schools in her county; otherwise, no student mentioned the ability or achievement level of the students. Jerry graduated from the same high school and “felt that it had prepared [him] well for college experiences.” Brad described high school as “fun”; we “learned a little…teachers passed some of us to pass us. Some of them, they really did care, but some didn’t.” In the same vein, Greg described his larger county high school as “laid back….We never had to do much…Never really had to study, but it was a good school and I learned the stuff that I thought I needed to learn.” Greg, as well as Luke, referred to his school as the “hick school…rednecks.”

All the students planned to go to college while in high school, even the student with the lowest high school GPA. All the students had parents or siblings that had graduated from or attended college. There appeared to be more of an emphasis on going to college as stated by Greg.

> My parents told me you have no choice – you're going to college, and I was like that's fine with me because I wanted to go anyway. I just wanted to go cause I've seen how hard my dad's had to work for everything and keeping food on the table and everything, and I don't want to have to work like that. That kind of lifestyle doesn't fit me anyway because I'm sort of lazy whenever it comes to blue-collar work.

Three students mentioned their guidance counselors. Diane went to her counselor as a friend, and Jim didn't feel the need to talk to his. Luke said despite his weekly visits to his counselor during his senior year, she rarely remembered his name and "did not help him with much of anything…Several people who had great experiences with her were teachers' kids and/or 4.0 students."

Job opportunities for work during high school were limited in the immediate area, but the students lived close enough to larger towns to find work in a grocery store or clothing store. Only Laura observed "it would be like I was going to a completely different place every day for school because the closest thing that we had around us was a gas station. It's out there…." The other students took advantage of work opportunities in suburban areas not all that far away. Jerry who was graduating from the community college at the end of the semester was the only student who perceived that his community had "less opportunities as far as employment from the career aspect." In contrast, Brad described a rather cosmopolitan picture of his parent's work; his father " is a stock, like

insurance investor.…[He] travels sometimes…to New York. And my mom…goes to the pool and lays out in the sun. She works in [local town] at Pro-Tec – she's a secretary."

None of the students spoke about the community being poor or neglected. One student, Luke, thought that his high school could do more with the landscaping and appearance of the facility to overcome its rural image. He said:

> …my biggest thing … is that appearance wise – like the flower beds were never weeded. They were never weeded, and that drove me absolutely crazy because people think of [high school B] as a hick-fest anyway. People do. I've got friends that think oh, [high school B], you know. But I think that's one thing that gives [high school B] such a bad rural image is that people don't have pride …

These students also described their neighborhoods as close-knit with strong family ties. Mary mentioned the loss of a "private life" in a small community because "there's a lot of gossip." One student described rural life as having a "slow pace that makes things easier." Even though one student had close neighbors, she felt that she lived far away from everything, meaning shopping centers and restaurants. Other students described living in a farm field with few neighbors to living on wooded acreage, which made life peaceful and quiet.

High School Mathematics

The themes that emerged from the data describing the students' high school mathematics experiences included the following: availability of courses and teachers,

characteristics of instruction, use of the graphics calculator, standardized testing, and the relevancy and application of mathematics. Students on a university/college path from high schools in both at-risk and transitional counties had similar experiences with the following: the required mathematics courses of Algebra I, Geometry, and Algebra II, not necessarily in that order; difficulty scheduling courses; good and poor instruction from mathematics teachers; caring and supportive teachers; use of graphics calculators; and Gateway Algebra I standardized tests. Students typically had different experiences with the following: the availability of different mathematics teachers, and teachers who used real-world examples or applied mathematics to the local community. I will discuss each theme, first from the perspective of students from at-risk counties, and then from the perspective of students from transitional counties.

Students from At-risk Counties

Courses

All the students interviewed took at least the minimum courses of Algebra I, Algebra II, and Geometry required for high school graduation and for a university/college track. Missy only had three mathematics classes because that was all that was offered at her school. Jenny only took three because her teacher "told me I didn't do good enough on my Gateway [Algebra I test]….She said it wasn't high enough but I found out later that it was." Mathematics was Joe's "least favorite just because I had hard time with it"; therefore, he stopped taking math after Algebra II. Meg went through Precalculus even though she said, "I don't like math. I didn't want to take nothing more than I had to." Charity took advanced math her senior year because "I thought it would help with

college, but it didn't. I just tried to take as many of the harder courses as I could." Cherie finished the Algebra and Geometry sequence by the middle of her sophomore year and elected to take Precalculus. She remembered thinking, "If I have these two years with no math, then how is that going to put me when I get to be a freshman in college?"

Teachers

All seven students had at least two different math teachers: two students had two, two students had three, and three students had four. Meg failed Algebra II with a teacher she called "the worse teacher in the world." Since no other teachers taught Algebra II, she had to retake the class with the same teacher and "barely passed it that time." Several students talked about the additional responsibilities that the teachers had, ranging from administration to coaching. One of Missy's mathematics teachers was the softball coach. She recounts that "he was never there and we had substitute teachers ….Most substitute teachers don't know the material …so we pretty much got to do what we wanted to do." She knew that this particular teacher had a history degree and said, "I'm not sure if he had a math degree."

Instruction

Six of the seven students described a situation where one teacher did well explaining the mathematics and one teacher who did not. Cherie said this about the range of experiences she had with her mathematics teachers:

> I had some of my math teachers that I was just – they were my heroes, I would have, you know, I'm still tempted to call them up and ask – I mean he used to study with me all

> the time. But I have another one that I had to go as far as to complain to the board of education ….

The comments that the students made about the teachers who did well include the following: the teacher took time to explain each step, the teacher sent students to the board to work problems, and the teacher helped students who made mistakes at the board. A good teacher explained the steps so that it made sense. Cherie said her teacher

> would pretty much let us open our books to the section, and he would talk about it, and he would just go step by step on the board and explain, you know, he would make sense to what we were doing. Instead of just saying this is what you do, I don't know why you do it, you do it. He would explain why we had to do whatever method it was, and it made sense.

Missy said her geometry teacher was from out-of-state. Because "she actually taught people things," the students "would get mad because they were use to doing whatever they wanted to do." This teacher varied the instruction to fit the learning styles of students as Missy explained, "She came out with new ways to do, well you know, some people learn differently, you know, visually, and all these different learning styles. She came up with different ways so people could get it different ways." Jenny, realizing good teachers have a knack of knowing students' questions, said, "He would answer without a question…." Meg admitted, "[My] Geometry teacher was hard but really good." Jenny said that her Algebra I teacher tried to make math relevant, "[He] would go

over something new because we were really so stressed out in that class like why do we have to learn this? He was coming up with reasons, you know, why we needed to learn it…." Overwhelmingly, students said that good teachers were ones that cared, as Cherie stated, "He was a good teacher but I wanted to learn more because he cared more….He cared if we understood or not." Caring teachers also offered individual tutoring outside of class.

The descriptions of instruction that was not good included the following: the teacher was not organized and would be easily distracted; the teacher quit halfway through class and said, "Do what you want to." The teacher "did not explain and I didn't learn anything." The teacher would "write things on the board; if nobody understood it, she would erase it and start on something else." Jenny described her Algebra II teacher having everything written out on an overhead, and the students would copy the notes down without teacher explanation.

> She used the overhead projector a lot. She had things written out already and that was - because of her up there explaining things, she would put that up, and you would copy the notes down. I didn't like that because she never explained anything. It was just basically you wrote down the notes that she had, and you did homework yourself. For some kids, that worked, for me it didn't. I needed it explained, you know, 'Why does this do this?' But she didn't do that.

Students did not like teachers who favored certain students or groups of students. Charity said:

> A lot of classes in my high school – or some of the classes that I had – the teacher was – had major pets. Especially if you were an athlete or something, so my Algebra II class, it was more of a joke.

Melanie remembered her teacher yelling if you were a girl. She said:

> …he just didn't really explain, and if you asked, you got yelled at if you were a girl, so… I got yelled at a lot if I asked questions, but I didn't ask questions. But like if they're a football player, they were on his good side, you know, and they passed, and they didn't have to try hard.

Graphics Calculator

All the students used a graphics calculator in at least one high school mathematics class although at one school the students used a scientific calculator in Algebra II rather than a graphics. The school supplied a classroom set, and only one male student interviewed bought his own. The students were accustomed to the teachers using an overhead projector with a calculator view screen to demonstrate the keystrokes used to incorporate the calculator in the lesson.

Standardized Tests

Receiving a passing grade on the Gateway Algebra I test was a graduation requirement starting with students entering ninth grade during the 2001-2002 school year; therefore, the recent high school graduates remembered taking the test. Charity recalled

doing "very well. It came easy." Joe and Melanie recollected it being harder; Melanie said, "I passed. I was a little bit above average." Joe recalled, "I thought it was hard…I always thought math was hard." Only Missy remembered using class time to study for the Gateway. She acknowledged, "Before we had the Gateway, we would cram…and I thought…we should already know this stuff…Like the month before we had to take it…we had to try to know what's supposed to be on the test…."

Relevance to Community

None of the students could describe lessons where their mathematics teacher taught a lesson using their community or locale. Nor could the students give specific examples of ways the teacher made mathematics relevant. Melanie thought that her teachers who were also coaches used "some stuff about the football or basketball team." Cherie thought that her geometry teacher might have because she recalled the teacher "tried to increase awareness of the usefulness of math." The norm for most teachers was to "teach strictly out of the book. Whatever was in the book, that's what they used."

Students from Transitional Counties

Courses

All the students except one had Algebra I, Geometry, and Algebra II. Brad did not have Geometry because he was on a technical path rather than a university path. He claimed that his school did not offer a huge choice of mathematics classes, but Mary took all seven classes that were offered at the same school. Brad's reasons for not taking more mathematics classes were that he "wasn't that good in math" and he "didn't like math." Curt did not take a mathematics course beyond Algebra II because of scheduling

conflicts. For the same reason, Jim did not take Calculus his senior year. Laura's school offered classes beyond Algebra II, but she had passed the classes she needed to graduate and "didn't feel like pressing [her] luck." Jerry described mathematics as his strongest subject and took Probability and Statistics rather than Precalculus although he could not remember why.

Teachers

All students had at least two different math teachers: one student had two; five students had three; four students had four; and one student had five. Luke remembered that his mathematics teacher his junior year was an engineer; he was "so technical and brainy and sometimes [he just didn't] know how to explain things…" Laura said her "first geometry teacher ran a construction business for the first 30 years out of college." She failed geometry and passed it with a younger teacher who taught so that "she could understand it." Other students had teachers who were sport coaches; Mary said that all three of her male mathematics teachers were football coaches, and two of them had a farm. Luke said that it was not a problem having coaches as teachers; they would use sport analogies at times but would seldom get sidetracked during class. On the other hand, Greg had a track coach for a mathematics teacher during track season, and he "was always out of the class trying to get track scheduling done…"

Instruction

Seven students described instructional methods of good teachers as follows: the teacher made students take notes; the teacher taught all the basics and tricks; the teacher was well-organized and had specific directions for what she wanted; the teacher showed

concern for the student and let students use notes on the quizzes. Kris described a young, male teacher who was her best instructor this way:

> …he was really involved, and he wanted to know everybody's troubles, and he let us use our notes for a lot of the quizzes and stuff just to help us, so we actually knew what we were doing. Like, instead of just guessing. So I really liked the way he taught, and he was a good teacher.

The teacher that Diane liked the most "took a lot of time at the beginning of class to go over our homework and any individual questions we had." She required all students to pay attention to everyone's question, and this helped Diane "a lot because [I] wouldn't want to ask about this certain question that [I] missed…"

Eight students described instructional methods of their worse teachers with the following statements: the teacher did not care; the student could not get help; the teacher did not know how to explain; and the teacher preached or lectured. Also, the teacher was scatter-brained; the teacher would get off-track, ramble, and was boring. Rich said:

> My geometry teacher would just go off and tell stories, and she would get off track. Well, at least it seemed to me that she was getting off track, and then she'd go back to drawing on the board the triangles and all that, and then the Algebra II teacher, he was just goofy, and he was a nut, and he was the same way. He would just ramble, and then he'd

> talk about math and ramble. It was kind of boring, actually, so I fell asleep a couple of times.

The students described classes that were never interactive, and the teacher never asked questions. Laura described one of her teachers this way:

> He'd mention a page in the book and then start doing examples on an overhead. He'd get off on tangents very easily, and he never really asked for questions, like we never – it was never an interactive class. He taught a lot, and we would listen. So, it was really hard to pay attention because he'd get off on these tangents, and in my mind, I'd get off on my own tangent, and then before I'd realize it, he was talking about something else, and I don't know where he was coming from, and I'd raise my hand to ask a question, and he'd say, "You can ask all the questions you want at the end of class. Right now we're going to cover this material."

Curt said that his Algebra II teacher was "basically preaching. She had stuff written down, the students copied it down, and she didn't really explain it much." Kris compared her college mathematics teachers to her high school teachers and said that her college math teachers answer the questions that her "high school math teachers just never wanted to or never seemed to want to answer…Things that don't make sense to you at all

in high school, college teachers are able to answer some of those questions or present it to me in a different way."

Graphics Calculator

All students were exposed to the graphics calculator. Greg's Algebra I and II teachers borrowed classroom sets from the neighboring middle school. Greg used one in geometry class his senior year and says that he really didn't need one and was never taught how to use it. Kris graduated from the same school and had similar experiences:

> We had calculators, but we never – they never taught us how to use calculators. That's because they had some we could use, but we were never really taught, and I really wish we would have because I have come here now, and a lot of students know how to use it, and my parents bought me one, and I still am struggling with how to do the basic things on a graphing calculator. So, I wish in high school; they would have at least had a class – not a whole class – but just like a certain part, like a few days to teach us how to use it…

Jim remembered that in high school teachers wanted students to write out steps by hand rather than use the calculator. Rich recollected that a scientific calculator was required rather than a graphics calculator. Only Laura recalled that students were not allowed to use graphics calculators on tests or in class because students "learned [how] to put games on the calculator and play them in class." She still doesn't "understand how to get from

one point to another on the graphing calculator." So she says that she could go with or without the calculator.

Standardized Tests

Four students described the Gateway Algebra I test as easy, even though one failed it. The students recall some class time used to prepare students to take the Gateway, as Kris states, "We studied for it a lot, but I found it very simple." Greg, who failed the test, does not remember class time spent in preparation. He said, "They didn't never set aside anything for the Gateway. They just figured that you got this and that's all you need."

Relevance to Community

Three students described examples where the teacher related math to the local community. Two of these students from the same school mentioned construction examples as a result of a school-wide project to build Habitat for Humanity homes. Jerry remembered that his probability and statistics teacher used real-life situations and applications that "made it very interesting and more exciting." Other students were vague on what they remembered with only one saying that projects were assigned both in-class and outside of class that were math related. For the most part, students remembered that teachers "stuck to the book" for examples and assignments. In fact, Kristen recalled her teachers saying to students "you won't use this again," referring to the mathematics in the lesson.

Preparation for College-level Mathematics

Themes that emerged from the data are the following: taking personal responsibility for not being prepared; or blaming other factors such as their mathematics teachers, unavailability of mathematics courses, and the guidance counselors. Students from at-risk counties who placed in college-level mathematics were more critical of their high school preparation and misuse of instructional class time than students in transitional counties. Students who graduated from high schools located in at-risk counties and transitional counties had these common experiences: some students took personal responsibility for their lack of preparations; other students blamed poor instruction by high school mathematics teachers; most students were critical of the lack of information given by guidance counselors. Student in both groups who placed in college-level mathematics were still critical of their lack of preparation and misuse of instructional class time. A difference between the two groups, at-risk and transitional, occurred in the following area: DSPM students from at-risk counties were more vocal about blaming their teachers for their lack of preparedness for college-level mathematics.

Students from At-risk Counties

Five students, four females and one male, are in a developmental math class at PSTCC in fall semester 2005. One of these is a female student who made 16 on the ACT Mathematics test and attended UTK and Walters State Community College where she took college-level math. She failed the college algebra course that she took at each school and placed into Elementary Algebra at PSTCC after taking the ASSET test. Two

students placed in college-level mathematics at PSTCC according to their ACT Mathematics scores of 19 or above.

The students who placed in DSPM gave these reasons for not being prepared for college-level math. Two students took responsibility citing that there was not enough time in their schedules to take math their senior year of high school. Joe explained, "I just forgot a lot of it 'cause I shouldn't have waited in between. I should have done something my senior year with math instead of just letting it go." Joe cited his poor attitude towards math; he did not like math and only took what was necessary. He said, "Math is probably my least favorite just because I have a hard time with it. It may be a part of why I hated taking math in high school so bad."

Four students blamed their high school mathematics teachers, citing poor instruction. Three students said the teacher showed favoritism towards other students. Melanie said, "I don't think I learned anything in math – as much as I could have. Just because of the fact that they had favorites and showed so much to this person rather than this person and not equal. I felt that when I graduated I didn't learn anything really." Another student thought the teacher did not make the mathematics challenging. Jenny said that teachers taught to the test, and "once the test was over…there wasn't anything that stuck in my head…" Melanie remembered, "The math [on the ACT] caught me off guard cause I didn't know really anything." Even though Joe took personal responsibility for not taking math his senior year in high school, he also said that he "didn't feel like I was ready for [Precalculus or Calculus]."

Charity failed College Algebra at the university because she did not go to class but thought she could have passed "if I had paid attention." Even so, she blamed her teachers for not teaching her how to study. She said:

> I thought in high school I was doing good because I was taking these other courses, but it was a shock once I got to college. I wasn't prepared to study, either, that was my one – that was my biggest thing starting out is the studying. It was never really – it wasn't taught how to do it really. You know, because it wasn't forced in school.

In preparation for taking the ACT Mathematics test, two students took a prep course. Neither of these two students made the cut-off score to place in college-level mathematics. Missy blamed the teacher who taught the course. She said that he was the softball coach who also taught her algebra courses. She recalled making a toothpick bridge in the prep class, which she thought did not prepare her to do well on the test. Joe said the prep course was available at his school, but he did not have time to take it. One student complained that the guidance counselor had not explained the importance of the ACT for placement in college.

Two students were prepared for college-level mathematics according to their scores on the ACT Mathematics test. Despite this, Jenny said that College Algebra was "not something that I could just slide right into cause I had to learn so much over." After the first test, she realized that she had to "study more and do more homework" in order to keep up with the other students in the class who "came in a

lot more prepared than I was." Cherie, who graduated near the top of her class, said that "most of my [high school] classes were jokes." All the students experienced class periods that were longer because of block scheduling. She remembers that her high school mathematics teacher would typically go over homework for the first ten to fifteen minutes of class, then use the next 45 minutes to cover new material. The remaining minutes would be unstructured, and students could do homework. She remembers frequent socializing and taking pictures. Melanie and Charity recalled getting their homework done in class and seldom taking a book home.

Students from Transitional Counties

Five students, four males and one female, placed in developmental mathematics. Two males took responsibility for not being prepared to take the ACT Mathematics test, one saying that he did not apply himself in high school and was a terrible test taker. The other male student took partial credit, saying that if he had reviewed for the placement test he could have done better. These students also blamed their mathematics teachers. Only Greg hinted that a math teacher showed favoritism when he said, "He wasn't a good teacher at all…He just sorta leaned toward the females in the class." Other reasons stated were low expectations of teachers, not enough college-level work, and students and teachers not working hard enough. Luke transferred from a private school to his high school and was surprised that "not as much was required from me as at the private school. There wasn't much homework." He wishes that his mathematics classes were more rigorous, especially the last two years of high school. Greg said this about his high school mathematics experience compared to his developmental mathematics classes:

> I believe if the teachers would have – like the algebra teachers would have put a little more into it and made us work harder then I believe that we would have understood more in college and be better prepared for the classes that we're taking and learn how to take better notes, learn how to do more homework, learn how to cover more material and things like that. It's just the fact of not really knowing how to take notes and not knowing how to do homework quickly.

Brad, too, compared high school mathematics instruction to developmental mathematics instruction at the community college and used the term "cover" to describe teaching. He didn't remember "doing [in high school] what we're doing now [in Elementary Algebra]. We never covered as much…."

Laura claimed that she took Algebra I in the eighth grade but decided not to get high school credit for the class. Instead, she did what her friends did and took the Foundations II/Algebra I sequence her freshman year. She placed in elementary algebra at the university she attended her freshmen year despite having high school credit for college-preparatory mathematics. She blamed her high school mathematics teachers for her failure to learn algebra in high schools because they "rushed through all the material that we had to learn" and did not "look at each individual student…[to] see where they're having problems."

These students also had block scheduling that allowed more time in class. Kris recalled that some teachers finished early so that students could start on their homework and ask questions. Luke was one of the few students who said that block scheduling was a problem. He said that he needed the repetition of doing mathematics throughout the school year; he had semesters in high school without mathematics and felt this hurt him on the ACT Mathematics test.

All the students named math teachers who offered extra help before school, after school, or between classes. Two of the schools used either the high school math club for tutoring or students from a local private college. Two of the students worked with private tutors that were hired by the family.

Six students placed in college-level math. Diane admits that the first time she took the ACT test she "didn't take it too seriously." After realizing the importance of making at or above the cut-off scores for college-level placement, she took it again. She felt that her high school did not tell her the importance of her scores on the ACT test. In hindsight, she wishes that she had taken a mathematics class her senior year. Kris also blames her high school for not providing information about the ACT test; she too felt that her ACT Mathematics score was lower "after a year of not taking a math class."

Jerry first went to the local university after high school and took College Algebra. He passed the course, but felt that he would not do well and transferred to the community college. Even though he described the university as an "eye-opening experience" and "with any high school, that's the situation," he considered himself prepared for college-

level work. The mathematics courses he took at his high school were “a challenge.” He took personal responsibility for his low grades in College Algebra at the university.

Kris took College Algebra at the community college and felt that she was “somewhat prepared, but… [not] prepared enough…” She specifically stated that high school mathematics classes did not prepare her to use the graphics calculator.

Rural Influence

In Table 9, the names of the students are listed by the economic status of the county where their school is located. The columns state the school from which each graduated, the placement of the student in either developmental (DSPM) or college-level mathematics (MATH), and how the student self-identified. In the last column, I made a decision concerning the students’ perceptions of the effect that rural had on their high school mathematics experience and preparation for college based on their answers to the interview questions. Answers were classified as one of the following: Yes - rural had a positive effect; yes – rural had a somewhat negative effect; yes – rural had a negative effect; yes – rural had a very negative effect; or No effect. Brad, who seemed to be the most immature of the students interviewed, did not answer the questions about the influence of rural on his high school mathematics experience. Perhaps he realized that he was to blame for his poor academic record, rather than the rural nature of his school. I used No Opinion for his response.

The table clearly shows that the economic status of the county plays a factor in the students’ perceptions of the influence of rural. Interestingly, both schools D and E are

Table 9 Students' Identification and the Influence of Rural on High School Mathematics and Preparation for College-level Mathematics

Name	School	Placement	Identification	Was rural a factor?
Transitional				
Diane	A	MATH	Rural	No
Jim	A	MATH	Not rural	No
Rich	B	MATH[1]	Not rural	No
Luke	B	DSPM	Not rural	Yes – somewhat neg
Kris	C	MATH	Not rural	Yes – somewhat neg
Laura	C	DSPM	Not rural	Yes – somewhat neg
Greg	C	DSPM	Rural	Yes - negative
Jerry	C	MATH	Rural	No
Curt	C	MATH	Not sure	No
Brad	D	DSPM	Rural	No opinion
Mary	D	MATH	Rural	Yes - positive
At-risk				
Missy	E	DSPM	Rural	Yes - very negative
Melanie	F	DSPM	Not sure	Yes - negative
Meg	F	DSPM	Rural	Yes - negative
Charity	G	DSPM[2]	Rural	Yes - negative
Jenny	G	MATH	Not rural	Yes - negative
Joe	G	DSPM	Rural	Yes - negative
Cherie	H	MATH	Rural	Yes - negative

[1]Rich's ACT MATH score would currently place him in MATH. At the time of his graduation from high school, a different placement test was used which placed him in DSPM.
[2]Charity's ACT MATH score would currently place her in DSPM.

K-12 schools, but are located in counties with different economic status. The range of perceptions from Missy, who was very negative about the influence of rural on her education, to Mary, who chose to attend a rural school for the personal attention afforded by small classes, is dramatic.

Themes that emerged from the data are the following: rural was a factor in the economic condition of the area and school, rural affected the availability and quality of teachers, rural influenced what the community expected academicallyfrom students, and rural had no effect. There were definite differences between the comments made by students from at-risk counties and transitional counties. The economic status of the county was a key factor as well as the expectations of the school administration, teachers, and community. DSPM students from both types of counties made similar comments about their mathematics teachers' expectations and instructional style.

Students from At-risk Counties

Students who graduated from high schools in at-risk counties were much more vocal than their more affluent counterparts about the ways that rural affected their high school math experience and their preparation for college. These students, both developmental and college-level, recognized that they were not as well prepared, and they did not have a quality high school education. Many blamed the low expectations of their parents, teachers, and administration. One student mentioned the limited selection of classes and teachers although every high school except one offered Algebra I through Precalculus. One student failed Algebra II under a teacher who she described as her worst teacher. Since there were no other teachers who taught Algebra II, she was forced to

retake the class under the same teacher. Another student observed that teachers at his high school were underpaid, and therefore not encouraged to put forth a lot of effort. Joe expressed his thoughts about his rural community this way:

> [My community] doesn't hold education very high. The teachers are very underpaid there. In fact, even after I graduated, left, most of the teachers that I had have gone, they've left the school. So it's not held, and I guess on their part, if they're not getting paid to do their job, I guess they feel like they don't have to do it, I guess. But it's not held – it's not important.

Jenny admitted that she did not have a great experience in high school and said this about the morale and parent support at her school:

> Drop out was pretty bad. Whenever I started high school, there were 175 kids, I think, and when I graduated, I think there was 120 something. So, there was close to 50 that dropped out or got pregnant – a lot of pregnancies where I live. I mean, my sister's a senior right now, and she could name, I think, 30 girls she knows that are, yeah. Not just in her grade, though. They, I mean, they start as young as 7th grade up there. It's just, I don't know. The parental support, I don't think is as good as it could be.

The students described most teachers as caring and very helpful. Many were willing to support the academic efforts of their students by coming early or staying after school to tutor. Meg described her geometry teacher this way:

> She stayed after school every single day, every morning, at homeroom, helped people. She was really good. If you needed help on another class, she'd help you. I'd go to her all the time. I went to her a long time. She was really good.

In contrast, Charity thought many of her teachers did not care about the academic success of their students. She said this:

> I think some of the teachers just didn't seem to care much. There was a lot of – well as far as coaches and stuff teaching, there was a lot of coaches in teaching – a lot of the classes. The college level classes like English – she tried, you know, to help you out as far as, you know, teaching college basics, but it was never – it was nothing, nothing. It was like night and day when I got to college it was a total shock to me….[My Biology teacher was] the only teacher that prepared me at all for college.

Missy blamed her rural community for not holding teachers accountable to properly educate students. She claimed that she would have learned if she had been taught, but since people "in rural areas are trying to get away with their teaching," she "totally agrees" that rural made a big difference in her education.

Students from Transitional Counties

Students who graduated from a high school in a transitional county were not as vocal about the influence that rural had on the math experience. Four of the college-level students said that attending a rural high school had no effect on their education. Diane said it best: “I guess it really didn’t because I think it depends on the teachers more that I had in high school than anything. I don’t think how I lived affected what I learned.” But living in a small community with classmates who she has known since preschool was beneficial; if she needed help with math, she “calls my next door neighbor to come over and help me because she is good in math.” Kris complained about the guidance counselors saying that counselors did not pay enough attention to the average student in the earlier high school grades. She thought it might have something to do with rural since the "school focuses a lot on agriculture and the [guidance counselors] push those kids to go to college."

The students who were placed into developmental courses at PSTCC believed the following about their rural, high school experience: the course content was the same, but the goals set by parents and teachers were lower; teachers were not as motivated to improve their instruction; students’ attitude and motivation influenced their success; and students could graduate with a college-preparatory diploma without being prepared for college-level work.

Greg made this observation: “Teachers and the rest of the county had the attitude that students were ‘not as smart people’. I guess for the simple fact that we are rural...” He thought the rural community and high school did not affect his preparation for

college-level math, but rather the teachers did. Greg stated," I believe that if the algebra teachers would have put a little more into it and made us work harder…" Greg was aware that the local newspaper published standardized test scores, and the local community compared the city and county schools based on these scores. Scores from his school were frequently lower than scores from the city schools.

Laura was aware that teachers in the county school system were paid a lower salary compared to city teachers and suggested that her rural school got the "second best" teachers. She acknowledged, "The better ones went where there's a lot of money."

Curt made this statement that could be said about the diversity of motivation and attitude of students in the larger county high schools: "They had that crowd and there was some that really didn't care at all – some that cared but really wasn't trying. There were those who wanted to do well and they did well." The larger, rural high schools in transitional counties had the size and diversity so that students in college-preparatory classes were motivated to do well and had the attention of guidance counselors as they prepared to go to college. Other students who were not as academically motivated or talented could get by without being challenged or prepared for college, and these students generally placed in developmental courses at the community college.

Chapter V

DISCUSSION, REFLECTIONS, AND RECOMMENDATIONS

Discussion

This study explored high school mathematics education from the perspective of community college students at Pellissippi State Technical Community College (PSTCC). These students were of traditional-age and graduated from a rural high school. The sample size is small for this qualitative study, but the consistency of themes in the data supports the following discussion.

A set of four research questions guided the study. In the first section, I discuss each research question, and then I reflect on my findings. Recommendations to high school mathematics teachers, high schools, community colleges, and for future research follow at the end of the chapter.

Question 1: What are the students' perceptions of growing up rural?

Graduating from a rural high school did not guarantee that the student grew up rural. Students who lived in counties some distance from metropolitan areas typically understood the meaning of the word rural and identified himself or herself as rural. Students who lived closer to metropolitan areas and drove out of town to attend the high school questioned whether they were rural for seemingly legitimate reasons. Arnold (2000) discusses this "lack of consensus on a definition for the term rural" and reasons that this is due to "the diversity and changing nature of rural areas." (p. 1) Interestingly, several students did not know the definition of the words rural, suburban, or urban, which in itself reveals an inadequacy in either teaching or their learning.

Growing up rural to the truly rural student meant limited opportunities

in many areas: school, work, future employment in the community, and social activities. Growing up rural meant living in a small, close knit community where everyone and everything were familiar. Growing up rural in an at-risk county meant getting a poor-quality schooling and knowing fewer family members and friends with college experience. For students living in these economically distressed areas with low income and poor employment prospects, growing up rural meant seeking post secondary education to have the skills to qualify for a good job and make a living income. These students grew up with parents commuting some distance to work, and they realized that they would probably do the same thing if they lived in the area. Growing up rural could be a meaningful and successful experience in counties where people have good incomes and the tax-base supports public education, and difficult and negative in counties where the socioeconomic status of the inhabitants is low, and the schools are under-funded. Across the economic groups, growing up rural meant having a simpler life-style and living in a community with strong family ties, morals, and caring attitudes.

Question 2: What are the students' perceptions of their rural high school mathematics experience?

The students' perceptions were affected by the economic status of the county where the high school is located. I used *transitional* and *at-risk* as the two categories.

Students from At-risk Counties

Student who graduated from high schools located in at-risk counties were much more negative about their experience. Students in these schools had fewer choices of classes and teachers. Higher-level mathematics classes such as calculus were only offered

if a teacher was available and enough students wanted the course. Mathematics teachers took a passive approach to teaching characterized by "covering the material" in a lecture mode. Students took notes, memorized rules and procedures, and learned tricks. Few teachers attempted to make the mathematics relevant to the community or incorporated real-world examples other than the examples in the text. There were good teachers who cared about the student and took more time during or after class to provide students individual attention, but many teachers did not make their mathematics class rigorous or challenging and allowed non-academic activities routinely rather than occasionally during class. Teachers who tried to teach more on a college-level were criticized for being too hard or mean. Too many teachers showed favoritism toward certain groups of students. Guidance counselors were generally characterized as unhelpful in providing assistance because they were overworked, or they just did not care. These comments were made by students who placed in DSPM as well as those placed in college-level courses.

Students from Transitional Counties

Students who graduated from high schools located in transitional counties had many more options for mathematics courses and teachers. The schools were larger so more advanced mathematics classes were offered on a permanent basis, and a broader array of teachers was available.

Students who placed in DSPM at the community college described situations where the mathematics class was less rigorous and challenging. The guidance counselors

were not as helpful in preparing the students for the college entrance tests and college choices as they appeared to be for the more academic or athletic students.

Students who were prepared for college-level mathematics according to their scores on the ACT Mathematics test were more positive about the rigor of the curriculum, the expectations of the teacher, and their experiences with the guidance counselors. But they also experienced teachers who were boring or not organized.

Question 3: What are the students' perceptions of the factors that contributed to their preparedness or lack of preparedness to take college-level mathematics?

I decided that the factors discussed by students from both at-risk and transitional counties dealt with the following themes: students' attitude and motivation, teachers' instruction and expectations, curriculum alignment, and guidance support. Each is discussed in the following sections.

Students' Attitude and Motivation

Students who did not like mathematics said that they took the minimum courses required for graduation following a university path. Students who did not dislike mathematics but had other interests said that mathematics was not a priority, especially during their senior year. In hindsight, several of these students realized that not taking mathematics during their final year in high school was a mistake.

Students who liked mathematics or who said that mathematics came easy generally passed their classes, sometimes with little effort. These students took the classes needed for a college-track diploma, and then took more if the courses were offered, and they had time in their schedules.

Teachers and sometimes guidance counselors advised students in all high schools of the benefits of taking higher-level mathematics courses in high school for preparation for college, and therefore many students took a higher-level course if available. Several students made poor grades in these courses, perhaps as a result of their attitude toward more difficult mathematics. In some cases, it appears that the student had not learned the prerequisite skills for those classes. Despite having high school credit for Precalculus, some students placed in DSPM at the community college.

In particular, male students who were not prepared for college-level math took personal responsibility, saying that they did not apply themselves during high school, were not good test-takers, or blamed their lack of preparation to a decision not to take a mathematics course as a senior in high school. The female students that were interviewed who placed in DSPM generally did not responsibility for reasons discussed in the following sections.

Teachers' Instruction and Expectations

Students who placed in DSPM from all the schools represented believed that poor instruction by many of their mathematics teachers and low expectations from both teachers and administration were factors in their lack of preparedness. Teachers wasted time in class, showed favoritism toward certain students, and did not challenge the students with meaningful or relevant mathematics lessons. All students received some instruction and use of the graphics calculator, although there were students who complained that it was not enough for their college-level coursework.

Curriculum Alignment with Assessment and Remediation

Although only one student mentioned the alignment of the mathematics curriculum from middle school through high school, I contend that this might be an issue that other students would have discussed if they had the vocabulary and family background of this student. I have seen too many DSPM students repeat the topics in pre-algebra, elementary algebra, intermediate algebra, as several of these students have, without mastering the core objectives or seeing the connections between objectives. In this study, I interviewed several students who were allowed to progress through Algebra I, Geometry, Algebra II, and even take and pass Precalculus, only to score poorly on the placement test because they could only work prealgebra problems.

Guidance Counselors' Help

In several schools, the students complained that the guidance office personnel were understaffed, overworked, or uncaring. It appears that not all college-bound students were getting the attention they needed to make the transition from high school to college. Some students blamed the guidance counselor for not making them aware of the importance of the ACT test to their placement in college-level classes.

The factors that appear to be more of an issue in *at-risk* counties are the low expectations of the teachers and administration and the poor teaching in all classes, not just mathematics. These students sensed that they were not prepared for college even though they had passed their college prep classes. Even students who took an ACT prep class were not prepared to make the cut-off score on the placement test.

Question 4: What are the students' perceptions of the effect that growing up rural had on their high school mathematics experience and their preparedness for college-level mathematics?

The students' perceptions appear to be greatly influenced by the location of the school and whether they were or were not prepared for college-level mathematics. I will discuss the effects of growing up rural from the perspective of the economic status of the county where they lived.

Students from At-risk Counties

Students from at-risk counties equated rural with poor and neglected, and this is how they described their schools. Both college-level and DSPM students felt that because their school was rural, the school had limited course offerings and choices for teachers, the teachers were not paid as well as in non-rural areas, and there was no incentive to teach in a rigorous or challenging way. Perhaps because their school was rural, the facility was in disrepair, and the people in the community were set in their ways and did not like change. Since the teachers did not take advantage of the rural community to illustrate the relevancy and usefulness of mathematics, the students experienced few ways that growing up rural was a positive influence on their high school mathematics experience. Finally, since the majority of these students were not prepared for college-level mathematics, they tended to blame their teachers and school for their academic placement in developmental classes or lack of success at the community college.

Students from Transitional Counties

In contrast, the students who graduated from schools in transitional counties had different opinions about the effect that rural played in their high school mathematics experience. Since the schools tended to be larger with more course offerings and choices for teachers, the students did not see that rural had a negative effect on their high school mathematics experience. Even in the smallest high school located in a K-12 school, a student took seven different mathematics courses. In contrast, the student from the high school in a K-12 school located in an at-risk county complained about the availability of mathematics classes. Students who placed in college-level mathematics were better satisfied with the preparation they received, and if they did not succeed in passing a class or a test, the students, particularly the male students, took the blame.

Students who placed in DSPM were more critical of their schools, citing poor teacher instruction and favoritism as issues that influenced their high school education. Developmental students were not the academically talented students in high school and did not appear to get the attention of teachers or guidance counselors, especially if they were not athletes.

Reflections

Mathematics Education

Despite the efforts of NCTM over the past decade to improve the teaching and learning of school mathematics, rural schools in East Tennessee appear to have lost out. I will address the six principles of school mathematics, which serve as overarching themes in the PSSM (2000). I am assuming that teachers, administrators, parents, and students in

rural schools share the same universal desire of wanting what is best for their students as those in suburban and urban schools, as described in the PSSM (2000), published by the NCTM. Again, the sample size is small for this qualitative study, but the consistency of themes in the data supports the following discussion.

> - ***Equity.*** Excellence in mathematics education requires equity—high expectations and strong support for all students. (p. 13)

The needs of all students are not being met. The students interviewed talked openly about the lack of high expectations from mathematics teachers and administrators. Despite the efforts of the NCTM to elevate the mathematics education of the average or below-average student in all locales across the United States, the equity principle is far from being a reality in the mathematics classroom in rural East Tennessee. Students were aware that teachers favored certain types of students with extra attention and higher grades. A well-stated mission statement or purpose displayed publicly on a sign or the school website is to be commended, but the real test is to ask the graduates who went into the workforce or postsecondary education to grade the school on whether the mission or purpose of the school is being accomplished.

Students graduating from rural high schools in at-risk counties are not getting the same mathematics education as graduates in wealthier areas. Furthermore, not all students in the same school received the same support from their mathematics teachers or guidance counselors.

> - ***Curriculum.*** A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades. (p.14)

From my conversations with these students, I would surmise that many of their mathematics teachers could not or did not adequately connect the topics in the lesson and also between lessons. Many teachers relied on the textbook for the content of the lesson and the connections with previously taught skills. I did not ask the student to describe the "important" mathematics he or she learned in high school. Several students stated that they remembered little mathematics from high school.

> - ***Teaching.*** Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well. (p. 16)

Current research stresses the importance of having qualified teachers in the classroom. Qualified teachers have the pedagogical content knowledge to teach effectively to all students, not just the brightest. Many of the students interviewed struggled with mathematics and did not get the support they need to be successful, perhaps for a variety of reasons: the mathematics teachers did not have the proper training for teaching or classroom management, the teacher did not have the support of the administration for keeping discipline and order, the teacher was overwhelmed with other responsibilities, such as coaching, or the atmosphere at the school, home, or community did not support the students' self-efficacy to achieve in mathematics.

Students could distinguish between teachers who cared and those who did not. It was apparent that students want teachers who care about them. Secondly, students want teachers who can teach, know their subject, explain the material, manage their classrooms efficiently, and engage the student in meaningful learning.

- ***Learning.*** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge. (p. 20)

Many students are not being taught to understand mathematics; rather they are taught a procedure that will always work, or a trick that will save them time. Many classroom lessons described by the students were not active, but very passive. The students took notes, or copied down what the teacher had written on the overhead. Students were not making connections with prior knowledge. Students could not relate what they "covered" in high school with the mathematics taught at the community college.

- ***Assessment.*** Assessment should support the learning of important mathematics and furnish useful information to both teachers and students. (p. 22)

The students graduated from high school with credits in college-preparatory mathematics courses but many were not able to make the cut-off score on a national standardized test to place in college-level mathematics. End-of-course testing after Algebra I determined that students were proficient, but national tests declared different results. The student's scores on the national standardized test were not being used to determine the skills the student lacked so that remediation could occur during the student's senior year.

- ***Technology.*** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning. (p. 24)

The sample size was small for this qualitative study, but there was some consistency in the students' use of the graphics calculator in their high school mathematics classes. Students typically used classroom sets of calculators rather than being required to have their own. This is contrary to the PSSM technology principle that advocates that real learning cannot take place if the student is not allowed time to experiment and investigate individually or in a group. The students were frequently not encouraged to use the technology of the graphics calculator to enhance their learning. None of the students mentioned using the graphing calculator to model real-life occurrences, nor did they remember using spreadsheets or dynamic system software in their high school classes. It was difficult for the students to describe how the graphics calculator was used in class, so I decided not to pursue further investigations in this study of how it influenced teaching or enhanced learning.

Rural Education

There are students graduating from rural schools in East Tennessee that are at a disadvantage. These schools need improvements. I am mindful of Howley's (1997) statement that "improvement in rural education requires logic quite different from the prevailing logic of school improvement. A changed perspective on the purposes of schooling is needed if educational researchers would help develop institutions that actually benefit rural communities" (p. 131). My research reveals that mathematics education in rural schools is not meeting the needs of all students to prepare them for higher education or today's work force. I do not want to "undermine improvement in rural education"(p. 132), but would recommend that improvements be made first for the

benefit of the rural community as argued by Howley (1997). Rather than changing the local culture and community, I advocate that mathematics teachers should help sustain it by integrating neighborhood concerns and issues into lessons and assignments. Engaging organizations and businesses in the local community in important mathematics lessons and activities is vital to maintaining a rural presence in today's curriculum. If this is done, these rural schools will become one of William's (2003) "flickers of hope…, rural schools … combining what is good about being rural with creative leadership, emancipating pedagogy and promising reform strategies…" (p. 2).

The NCTM's Principles and Standards (2000) recommend involving the community as well as parents in decisions involving curriculum and materials. "Choices of instructional materials should be based on a community's agreed-on goals for mathematics education" (p.369-370). This would require a great deal of communication and consensus among teachers, administrators, parents, and the larger community. "Teachers and administrators should invite families, other caregivers, and community members to participate in examining and improving mathematics education. All partners in this enterprise need to understand the changing goals and priorities of school mathematics…" (p. 378). It is no longer an option for parents to excuse their children from learning mathematics just because "they were bad in math or they never use math." Parents, as well as the larger community, need to understand the importance of mathematics for their child's success in school and for meeting the needs of their rural community.

Teacher Education and Professional Development

Much-needed improvements in mathematics education in East Tennessee's rural schools will not happen unless changes are made in the quality and quantity of the mathematical and pedagogical knowledge of elementary school teachers and secondary school mathematics teachers. Howley and Howley (2004) discuss the needs of rural preservice and inservice teachers for increased subject matter knowledge. They argue that professional development should connect "schooling and the broader community purposes" and "ground curriculum and instruction in the civic and economic life of a rural place." Tennessee is addressing these problems, first by making the public aware of the mathematics proficiency of K-12 students and the issues of teacher preparation and professional development, by publishing a special study by the Office of Education Accountability (Potts, Chatis, & Lyttle, 2005).

This study discusses many of the same concerns that surfaced in my research: the differences of achievement levels on state mathematics assessments and national tests, the need for college-prepared high school graduates to take developmental classes, and the instructional style of rote memorization commonly used by high school mathematics teachers. The study concludes with recommendations for policy makers at the local and state levels. Rural communities must take the responsibility for action to insure that state agencies not overlook the needs of their schools in deference to the needs of schools in more areas.

Recommendations

Recommendations to High School Mathematics Teachers

Equity

1. Treat all students equitably. Show that you care about the success of every student. Provide individual attention and support as much as possible. This is consistent with the recommendations of the final report of the National Commission of the High School Senior Year (2001b).
2. Determine the learning styles of your students and vary your instruction to meet the needs of your students.

Pedagogical Management

3. Monitor your workload.
4. Make every minute of class time count. Be organized and keep your class on task. Be creative.
5. Expect more of your students. Give assignments that are completed out-of-class with deadlines and consequences. Too many students were able to complete all their homework in class. College classes expect homework to be done outside of class.

Professional Development

6. Attend professional developmental activities sponsored by local, state, and national mathematics organizations. Make use of the Internet and distance education in isolated locations.
7. Seek a higher degree in mathematics education through the local university or the ACCLAIM program.

Collaboration

8. Work with your peers in the mathematics department, targeting students who need continued monitoring across mathematics courses. Too many students get through the academic pipeline of Algebra I, II, and Geometry without mastering the core objectives. This recommendation supports Barth's (2002) recommendation to "help students before they fail" (p. 21).
9. Work with guidance counselors and administration on ways of using the results of the ACT Mathematics test to dictate which mathematics course the student should take the senior year.
10. Work with your peers in other subject areas so that the same expectations are required in all subject areas.
11. Work with peers, administration, community leaders, and local employers to find ways to make learning mathematics more relevant to the students through place-based lessons.

Technology

12. Attend professional development activities featuring ways to integrate technology in the classroom. Take advantage of grants that provide technology and training.
13. Work with book companies who provide technology software supplements and enhancements with textbooks, and the training to help with classroom facilitation.

Recommendations to High School Administration

Professional Development

1. Mathematics teachers need continuous professional development to increase their knowledge and skills in mathematics and the teaching of mathematics.
2. Re-evaluate block scheduling. Train teachers to use time in-class effectively.

Administration

3. Attract and retain qualified teachers. Substitute teachers need to be qualified to teach the subject or at least trained.
4. Monitor the workload of coaches and guidance counselors.
5. Re-evaluate how guidance counselors are assigned to students when initial contact is made with student and the quality and quantity of continued contact. Since fewer rural students have access to computers or have Internet connections, make sure all students are informed in multiple ways.
6. High school administrators should treat teachers as professionals and demand higher standards from teachers and students.

Assessment

7. Require testing junior year and use results to decide which mathematics course the student takes senior year. Review courses students take senior year and offer dual credit or co-credit classes. Make senior year valuable rather than a waste of time. This is consistent with the recommendation of Berry (2003) that "high school students …receive placement testing during their sophomore or junior year; this can provide concrete evidence to students that they need more math" (p. 406).

8. Recommend to your state board of education that the cut-off scores on the Gateway Algebra I test be raised.

Collaboration

9. Use the local community as a laboratory for learning. Involve parents and community businesses in ways to make mathematics more relevant and get students involved in a legitimate work experience. This recommendation is discussed in the Rural School and Community Trust (2004) policy paper on the characteristics of good rural high schools.
10. Help parents and students become aware of the amount of knowledge and level of skill required to succeed in post secondary education and today's workforce. Get community leaders involved in keeping youth active and involved. Connect youth to the outside world so that they are aware of what if takes to succeed, as well as the benefits of living and working in their own community.
11. Share the concerns of the local policymakers with the state policymakers. Arnold (2000) argues that "states should have a system for facilitating this participation….Local stakeholders should find ways to constructively share their concerns because state policymakers may not fully realize the implications of implementing policies in rural contexts" (p. 4).

Technology

12. Work with the mathematics faculty to increase the use of technology to enhance teaching and improve learning.

Recommendations to State Policy Makers

1. Evaluate state standards in mathematics to assure that students are prepared for higher education and the workforce. This recommendation is supported by several, recent reports (Achieve, Inc., 2004; Potts, et al., 2005; Spann, 2000; THEC, 2002b;)
2. Many rural schools are in poor condition and the community cannot afford to upgrade the facility (McColl & Malhoit, 2004). Evaluate state policies to insure that state funding is available for poorer, rural districts. Involve rural parents, students, and community members in the discussion of the "amount of funding schools need to educate students to high standards" as suggested by Malhoit (2005, p. 3).

Recommendations to Community College Faculty and Administration

Equity

1. Treat all students equitably. Show that you care about the success of every student. Provide individual attention and support as much as possible.
2. Determine the learning styles of your students and vary your instruction to meet the needs of your students. This recommendation is supported by The Education Alliance (2006).

Professionalism

3. Seek higher degrees in Mathematics Education from the local university or the ACCLAIM program.

4. Work with high school administrators and teachers to offer dual or co-enrollment classes for high school seniors to earn college credit. This is consistent with the recommendation of Barth (2002) who suggests that using higher education faculty to teach high school courses could help the teacher shortage.
5. Provide information to students, guidance counselors, and parents in a variety of ways including the Internet.

Collaboration

6. Offer opportunities for collaboration between college mathematics instructors and high school teachers through professional organizations or campus visits. This collaboration, "designed to improve educational practice", is supported by the Statewide Master Plan for Tennessee Higher Education 2000-2005 (THEC, 1999, p. 11).
7. Provide opportunities for students to get to the college campus through mathematics contests and field trips.

Technology

8. Attend professional development activities featuring ways to integrate technology in the classroom. Take advantage of grants that provide technology and training.
9. Work with book companies to provide technology software supplements and enhancements with textbooks, and the training to help with classroom facilitation.

Recommendations for Future Research

The results of this study indicate the need for additional research in the following areas:

1. A case study of a particular high school where higher percentages of high school graduates place in DSPM at the community college.
2. A quantitative study that compares: a) high school mathematics GPA and achievement test scores in mathematics of rural high school graduates to non-rural graduates, b) retention and success of rural high school graduates in DSPM and college-level mathematics classes at the community college to non-rural high school graduates, or c) placement with success of rural and non-rural students in DSPM and college-level mathematics.
3. An interview study with high school mathematics teachers, both rural and non-rural, that explores their perceptions of students' high school mathematics experiences.
4. Replicate this study with traditional-aged, suburban and urban students.
5. Study the locus of control or self-efficacy of DSPM students compared to students prepared for college-level mathematics, or rural versus non-rural students.
6. Investigate the use of technology in rural versus non-rural high schools.

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APPENDICES

APPENDIX A

Survey

Fall Semester 2005

The following information is needed for research for a dissertation in mathematics education at University of Tennessee Knoxville. Participation in the study is voluntary and is not a requirement of Pellissippi State.

1. The name of the high school from which you graduated or attended. If the high school is NOT located in Tennessee, please name the state.

_____ _____
High School State

If you did not attend or graduate from high school, then name the county in which you presently live.

_____
County

2. Your present age: _____

3. Your gender. **Circle one**: male female

4. The mathematics class that you are currently taking. **Circle one**.

DSPM 0700 DSPM 0800 DSPM 0850

MATH 1010 MATH 1130 MATH 1410 MATH 1420 MATH 1530 MATH 1630

MATH 1710 MATH 1730 MATH 1830 MATH 1910

5. The purpose of this study is to explore high school mathematics education from the perspective of rural, community college students.

Do you consider yourself rural? **Circle one.** Yes No

If you are selected for an interview, I will contact you to set up a time and place. If you are willing to be interviewed, please provide the following information so that you can be contacted. This information will not be used for any other reason.

Name_____

Telephone number_____

Email_____

Thank you.
Caroline Best

APPENDIX B

Interview Questions

1. What do you think of when you hear the word rural?
2. What feelings does the word rural elicit?
3. Describe your high school as if you were telling a new friend at PSTCC.
4. What mathematics courses did you take in high school?
5. Did your high school offer the mathematics courses that you wanted to take? If not, what were they and why do you think that they were not offered?
6. Describe how your mathematics teacher taught on a typical day in high school. What instructional methods were used? Compare how the math is taught in your PSTCC mathematics class to what you remember in high school.
7. What support did your mathematics teachers provide to help you be successful in mathematics or attend college?
8. Describe how your mathematics teacher(s) related or applied mathematics to the community or locale where you live.
9. How well prepared are (were) you to take college-level mathematics at PSTCC?
10. How did living in a rural community or attending a rural high school effect your preparation for college-level mathematics?

APPENDIX C

INFORMED CONSENT FORM

Dissertation
Rural, Community College Students' Perceptions of High School Mathematics

INFORMATION

You are invited to participate in a research study. The purpose of this study is to explore mathematics education from the perspective of rural, community college students enrolled at PSTCC.

Selected students enrolled at Pellissippi State Technical Community College (PSTCC) fall semester 2005 and/or spring semester 2006 will be interviewed.

Each interview will be recorded and transcribed.

The initial interview will last approximately 60 minutes. You may be asked to participate in a follow-up interview.

BENEFITS

This study will add to the body of knowledge information about rural students' talents, gifts, and rural values, and the mathematics education the student received in a rural high school.

CONFIDENTIALITY

The information in the study records will be kept confidential. Data will be stored securely and will be made available only to persons conducting the study unless you specifically give permission in writing to do otherwise. Any information that may identify you will be deleted or altered to protect your anonymity. No reference will be made in oral or written reports that could link you to the study.

COMPENSATION

For participating in this study you will receive a $15 gift certificate to the PSTCC bookstore.

_____Participant's initials

CONTACT

If you have questions at any time about the study of the procedures, you may contact the researcher, Caroline Best, at (865) 983-6143, or cbest@pstcc.edu. If you have questions about your rights as a participant, contact the Research Compliance Services section of the Office of Research at (865) 974-3466.

PARTICIPATION

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT

I have read the above information and agree to participate in this study. I have received a copy of this form.

Participant's name (print) _____

Participant's signature_____

Date_____

APPENDIX D

Spradley's Semantic Relationships

Relationship	**Expressed as**	**Example from Data Analysis**
1. Strict inclusion	X is a kind of Y	A part-time job is a kind of real-world learning experience for rural students.
2. Spatial	X is a place in Y	A rural high school is a place where students feel comfortable.
3. Cause-effect	X is a result of Y	Student's unpreparedness for taking the ACT is a result of poor guidance in high school.
4. Rationale	X is a reason for doing Y	Living in an isolated area is a reason why students identified *rural.*
5. Location	X is a place for doing Y	A football game is a place for rural students to socialize.
6. Function	X is used for Y	ACT Math test score is used to determine students' preparation for college-level math.
7. Means-end	X is a way to do Y	Tutoring outside of class is a way for teachers to help rural students be successful.
8. Sequence	X is a step in Y	Taking college-prep math courses is a step for being prepared for college-level math.
9. Attribution	X is a characteristic of Y	Open country is a characteristic of rural.

APPENDIX E

Semantic Relation Worksheet

Included Terms	Semantic Relationship	Cover Term
_____		
_____		
_____	→	_____
_____		
_____		
_____		
_____		
_____		
_____		
_____		
_____		
_____		
_____		

APPENDIX F

Outline of Findings

I. Rural Identification

A. Reasons why

1. Students self-identified rural
2. Students self-identified non-rural
3. Students were not sure

B. Influence of self-identification, gender, math placement, and location of high school on perception of rural

1. Self-identification
2. Gender
3. Math Placement: college-level or DSPM
4. Location of high school: at-risk or transitional county

II. Growing up rural

A. In an at-risk county

1. Schools, teachers, administration, and related activities
    a. Transportation
    b. Size
    c. Diversity/cliques
    d. Sport/social activities
    e. Teachers/administration
        i. Relationships with students
        ii. Favoritism
    f. Discipline
2. College plans
    a. Rigor/challenge of courses
    b. Help from guidance counselors/teachers
    c. Influence of parents/family/community
3. Community
    a. Economic status
    b. Job opportunities

B. In a transitional county

1. Schools, teachers, administration, and related activities
    a. Transportation
    b. Size
    c. Diversity/cliques
    d. Sorts/social activities
    e. Teacher/administration
        i. Relationship with students
        ii. Favoritism
    f. Discipline
2. College plans
    a. Help from guidance counselors/teachers
    b. Influence of parents/family/community
3. Community
    a. Job opportunities
    b. Economic status

III. High school mathematics

A. Schools in At-risk counties

1. Courses offering
2. Number of different teachers
3. Characteristics of Instruction
    a. Students' perceptions of good teaching
    b. Students' perceptions of poor teaching
4. Use of graphics calculator
5. Standardized testing: Gateway
6. Relevancy/application of math

B. Schools in Transitional Counties

1. Courses offered; what students took and why
2. Number of different teachers; what they taught, coached
3. Characteristics of Instruction
    a. Students' perceptions of good teaching
    b. Students' perceptions of poor teaching
4. Graphics calculator
5. Standardized testing: Gateway
6. Relevancy/application of math

IV. Preparation for College-level Math

A. Students from At-risk counties

1. Who were not prepared for college-level math (<19 on ACT Math test)

a. Took responsibility

i. Did not take math senior year

ii. Did not study

b. Blamed teachers because of

i. Poor instruction

ii. Student not taught or forced to study

c. ACT prep course not adequate

d. Guidance counselors did not inform students

2. Who placed in college-level math (≥ 19) were critical about

b. Lack of preparation

c. Misuse of class time

B. Students from Transitional counties

1. Who were not prepared for college-level math (<19 on ACT Math test)

a. Took responsibility

i. Poor test taker

ii. Should have reviewed for placement test

b. Blamed teachers

c. Guidance counselors did not inform students

2. Who placed in college-level math (≥ 19)

a. Not told about importance of ACT

b. Lower ACT because no math senior year

V. Rural Influence on Math Experience and Preparation

A. Students from At-risk counties, both DSPM and MATH

1. Rural = poverty/neglect/low expectations

2. Teachers

3. Instruction

B. Students from Transitional counties

1. MATH students: rural had no effect

2. DSPM students: some effect

VITA

Caroline Munn Best was born on June 2, 1950 and was raised in Cartersville, GA where she attended public school. She graduated from Maryville College, Maryville, TN with a B.A. in Mathematics with certification to teach grades 7-12. After graduation, she taught eighth grade mathematics for 1 year in Cartersville and 2 ½ years at Carter Middle School, Knox County, TN.

Upon moving to Chattanooga midyear, she began coursework on a master's degree in education with a concentration in mathematics at the University of Tennessee, Chattanooga (UTC). During this time, she taught developmental mathematics part-time at Chattanooga State Technical Community College. After graduation in 1977, she taught mathematics as an adjunct at UTC and also supervised the mathematics lab for developmental mathematics students while her children were young. After moving to Maryville, she returned to full-time teaching at Pellissippi State Technical Community College (PSTCC) where she is currently coordinator of developmental mathematics.

Caroline plans to continue her work with developmental students at the community college. She is a member of the National Association for Developmental Education (NADE) as well as the National Council of Teachers of Mathematics (NCTM) at the national, state and local levels. This dissertation is another step towards a better understanding of the needs of traditional students, and how the developmental studies program can best meet these needs while providing a viable program for all students. Although PSTCC is not a rural community college, young people live in the foothills of the Great Smoky Mountains and the Cumberland Mountains and attend PSTCC to prepare for the local job market and the global challenges of the 21st century.