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I am submitting herewith a dissertation written by Craig Alan Green entitled “Annenberg Rural Challenge Ten Years Later: Looking for a Place for Mathematics in a Rural Appalachia Place-based Curriculum.” 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.

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THE ANNENBERG RURAL CHALLENGE
TEN YEARS LATER:
LOOKING FOR A PLACE FOR MATHEMATICS IN A RURAL
APPALACHIA PLACE-BASED CURRICULUM

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

Craig Alan Green
August 2008

DEDICATION

This dissertation is dedicated to my wife,
Carol McCarter Green,
who never stopped believing in me during the many days we were apart.
Our time has come.

ACKNOWLEDGEMENTS

I wish to thank my family--- Amy and Hannah who let Daddy go for awhile; my parents A. J. and Irene Green who were always a shelter in times of need; Carey, Vic, and Vince who are my Band of Brothers; Cathryn McCarter who is the definition of a great mother-in-law; Jo, Rick, Wes, and Kate Farnan who have shared their lives with Uncle Craig; Momma Di and Daddy Russ Meek who have helped Carol hold the fort down over the years; all my aunts, uncles, and cousins who have helped me grow as a person.

I wish to thank all of the people who helped me with the research and the writing of this dissertation: Doctoral Committee Members: Dr. Vena Long, my doctoral committee chair, who made this possible with inspiration and perspiration despite my personal velocity; Dr. P. Mark Taylor, who gave great advice, Dr. C. Edward Roeske who supplied timely encouragement to finish the job, and Dr. William Wade who provided the cutting criticism that sharpens the sword.

The ACCLAIM 2002 Cohort I: Barbie, Bill, Brenda, Brian, Caroline, Christie, Crystal, Debbie, Frank, Karla, Judy, Julianna, and Sue.

The teachers and administrators of TennGaLina Rural Challenge cluster.

I wish to thank to the people involved with the ACCLAIM program: Your efforts gave me the opportunity.

I wish to thank the people at home, in Copperhill: my students, fellow teachers, and friends.

Lastly, I want to recognize people who were part of the journey but did not get to see the end: Sonny, Aunt Carolyn, Diane Stiles, Max “Are you a doc, yet?” Bruce, and the unforgotten Frank Borbeck.

ABSTRACT

This quantitative study explored whether or not the mathematics curriculum and instruction of the schools in the TennGaLina cluster were impacted by the place-based educational reform promoted by the Annenberg Rural Challenge.

The study focused on the programs of five small rural Southern Appalachian schools.

Qualitative methods of grounded theory were used to analyze data from interviews, surveys, and school artifacts.

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Chapter I

Introduction

This study examined a prominent educational reform program, the Annenberg Rural Challenge, which was developed to meet the needs of educational agencies in rural locales. Specifically, the study gathered and analyzed data from an Annenberg cluster of five small rural Southern Appalachian schools and offers insights about the dynamics of how mathematics was treated in the program, what approach was used to address pedagogy and curriculum, and the residual effects, if any. Information was gathered with respect to the teaching and learning of mathematics keeping in mind the intended purpose, the actual practice, and the status ten plus years later.

In December 1993, Ambassador Walter Annenberg announced that the Annenberg Foundation would establish the Annenberg Challenge, a \$ 500 million project focused on improving large, urban, public school districts in the United States. The year after the initial announcement, rural educators and advocates associated with the Foundation insisted on the Challenge going beyond the urban setting. They advanced the idea that a national reform of schools was more likely to succeed in the rural schools rather than the large urban centers (ARC, 1997). A planning committee submitted a proposal for a national project that would develop a grant program with a set of activities designed to sustain over time a large rural education movement. Two main components of the reform were the formation of small cluster of schools and engaging school and community in place-based curriculum. The Annenberg Institute accepted the proposal in 1995 and pledged \$50 million to support the Annenberg Rural Challenge.

The Annenberg Challenge

Walter Annenberg, publisher, philanthropist, and former ambassador to Great Britain, announced the Annenberg Challenge in December 1993 pledging a \$500 million gift to the nation's public schools. His action was billed as an "unprecedented challenge to an American public increasingly vocal about the need for school improvement"

(Annenberg, 1997). Annenberg called upon communities to "take the necessary tough political steps" to fulfill America's democratic obligation to educate all of our children well. To help stimulate other foundations and corporations to give, he provided that most of the funds promised would become available only on a matching basis. Annenberg's "Challenge to the Nation" became the largest public/private endeavor in U.S. history dedicated to improving public schools. The Annenberg Institute further described the structure:

Eighteen locally designed Challenge projects operated in 35 states, funding 2,400 public schools that served more than 1.5 million students and 80,000 teachers. Over 1,600 businesses, foundations, colleges and universities, and individuals contributed \$600 million in private matching funds.

Each Challenge project fit unique local conditions. Each was designed by a local planning group comprised of educators, foundation officers, and community and business leaders. Independent, non-profit entities --- in most instances, specially created organizations that evolved from the collaborative planning groups and led by a community governing board --- ran the projects.

Grants ranging from \$10 million to \$53 million were awarded to sites in Boston, Chicago, Detroit, Houston, Los Angeles, New York City, Philadelphia, the San Francisco Bay Area, South Florida (encompassing Miami-Dade, Broward, and Palm Beach

Counties), and the Rural Challenge, which worked in hundreds of communities. Smaller "opportunity grants" of \$1 to \$4 million were awarded to sites in Atlanta, Baltimore, Chattanooga, Chelsea (MA), and Salt Lake City.

Three additional Challenge sites focused on enhancing arts education: The Center for Arts Education in New York City, the Arts for Academic Achievement in Minneapolis, and the national Transforming Education through the Arts Challenge, comprised of six regional consortia members in California, Florida, Ohio, Nebraska, Tennessee, and Texas.

The Challenge also awarded grants of \$56.7 million to New American Schools, \$50 million to the Annenberg Institute for School Reform, and \$6.5 million to the Education Commission of the States. To coordinate and support the reform projects, the Annenberg Foundation provided supplemental funding to staff a small national Challenge office at the Annenberg Institute. (The Annenberg Institute, 2003).

The Rural Challenge

Annenberg's "Challenge" was based on the idea that the nation had a democratic obligation to educate all of America's children well. The original Challenge focused on urban areas and did not include rural areas. According to Paul Nachtigal (2000) the first Executive Director the Rural Challenge, Mr. Annenberg initially intended the money to only go to the large urban cities whereas the rural project was an afterthought. Many staff and researchers at the Annenberg Institute insisted that a rural component should be included. Former Brown University President Vartan Gregorian, a pro bono advisor to Mr. Annenberg stated,

No national school reform movement is complete unless it includes America's rural schools. Approximately half of our country's public school districts are rural ones - as are a third of the nation's schools and a quarter of America's teachers and students. These thousands of rural public schools are astonishingly diverse. Some of the nation's finest schools, as well as some of its mediocre ones, operate well beyond the cities and suburbs (News From Brown, 1995).

The Rural Challenge was designed to encourage and assist rural schools and communities to build on the strengths of their small scale, to take full advantage of their ruralness, to develop "a pedagogy of place", and to create unique rural paths to educational excellence for all their students (Annenberg, 1997).

Initially, the Rural Challenge united a select group of respected rural school reform networks to deepen their own work, to work collaboratively with each other, and to prepare themselves to assist the next wave of participating schools, communities and support organizations. "First, we want to acknowledge the pioneering contributions of the groups who are our most obvious potential partners in the world of rural school improvement," said Jack Murrah (then National Board chair). "Then we want to identify and become partners with the extraordinary rural schools, communities, and organizations rarely known or celebrated beyond their immediate constituencies." (News From Brown, 1995).

The Rural Challenge eventually grew to include thirty-five separate projects in three types of network/clusters: large statewide networks, specific program networks and small clusters. The statewide networks, such as the Appalachian Rural Education Network, were originally called "Founding Partners" and existed before the Rural Challenge. Because of their university affiliations and collaborations with various state agencies, the networks were thought to be needed to add credibility to the initiative.

These first year grantees, as they were later called, received over fifty percent of the total funding to use their personnel to provide technical assistance and training programs to individual schools and clusters.

The second year grantees, also existing before the Rural Challenge, were the specific program networks. These programs were designed around a specific skill or theme. For example, the Southern Initiative of the Algebra Project was chosen because they could provide training and leadership to improve achievement in algebra while training parents to become involved in school and community matters. Furthermore, these organizations were to show the small clusters how to utilize a variety of networking tools to keep members interconnected and communicating.

Clusters in the Rural Challenge

The third year grantees were called small clusters and consisted of small rural schools with some uniting component, such as geographical proximity. These clusters were comprised of between three and twelve schools. As part of the structure, a board was created to develop a process of inviting school districts and groups into the grants process. The rural schools invited would have to abide by the Rural Challenge's core beliefs concerning school reform, namely, the creation of school networks and engaging school and community in a place-based curriculum. To help pool resources and overcome the isolation of rural schools, the Rural Challenge board insisted that funded projects be organized in networks and clusters. In addition, the board maintained that rural schools were intrinsically community-based (Sher, 1995). Any rural reform movement would have to facilitate changes in relationships between schools and communities. The potential to transform rural schools would come from a revolution where schools were

one of many community centers for learning and the curriculum of place was to be central to the work of students across subject matter. However, the idea of “pedagogy of place” was very difficult to imagine because there was very little practical experience noted by the participants (ARC, 1997). The Rural Challenge spent the first year of the project developing just how the study of place should be implemented.

Originally based on David Orr’s work (1992), the Rural Challenge eventually described place-based education this way:

A grounded, rooted learner understands that his/her actions matter, that they affect the community beyond the school. It is out of this particular formulation that the student as a resource to the community’ takes shape...a pedagogy of place, then, recontextualizes education locally. It makes education a preparation for citizenship, both locally and in wider contexts, while also providing the basis for continuing scholarship (ARC, 1999b).

Evolution of the small clusters

The small clusters were to follow the lead of a partnering network. A cluster was to rely on regular interactions of associated institutions, community agencies, and other members of the cluster for expanding and extending place-base work in the schools and the communities. The clusters were to develop a consortium of people in the schools and communities to plan, articulate, and sustain the vision for the cluster as a whole. The Rural Challenge funding required the clusters to focus on curriculum innovation that related to the local community setting and on ways to integrate place-based with state frameworks and content standards. The schools were encouraged to alter traditional schooling practices by receiving mini-grant incentives to facilitate those changes. Furthermore, the clusters were required to publish a document to be shared with the other cluster that showed examples of the curriculum innovations they had tried.

At the end of each funding year most clusters submitted portfolios to the national board highlighting each individual school's work as well as the work of the cluster as a whole. These portfolios were a part of the evaluation process and were to show that clusters were implementing the goals of the Rural Challenge. The Annenberg funding ended after the third year. Many of the original leadership anticipated that the clusters would develop a national network or a movement to provide specific services to rural schools and communities. They wanted to create an ongoing dialogue about the purpose of schooling, ---whose interests are served and who gets to make the decisions about those interests. They realized that changing the culture of schooling to include the local communities would take longer than three years (The Rural School and Community Trust, 2000).

After the Rural Challenge funding came to an end in 2000, a new, non-grant making organization named the Rural School and Community Trust carried on the work in the networks and clusters. The Trust mainly focuses on advocacy, research, and outreach to rural schools and their communities. In spite of the new support organization, some of the clusters did not continue while others found new sources of sustainability and continued as part of the national network. Still other clusters survive independently choosing not to belong to any national association (The Rural School and Community Trust, 2000).

Examination of the data produced by any of these clusters should add to the literature concerning educational reform in small rural schools. The Annenberg Rural Challenge championed the idea of reform based on the pedagogy of place. There is an abundance of references to the power that place-based pedagogies hold for rural students

and rural communities (Gruenewald, 2003; Haas & Nachtigal, 1998; Harmon & Branham, 1999; Howley et al., 1996; Kannapel & DeYoung, 1999; Ley, Nelson, & Beltyukova, 1996; Long, Bush, & Theobald, 2003; Theobald & Nachtigal, 1999). I am particularly interested adding to the literature concerning the impact of the pedagogy of place on the teaching and learning of mathematics in small rural schools of the Appalachia. The collection of materials from the TennGaLina cluster provided the necessary data. I examine and report what emerged from the TennGaLina cluster as place-based mathematics.

Statement of the Problem

To what extent and in what ways do placed-based education programs impact the mathematics of schools that participate in such externally funded programs, the students, rural families, and communities? Is there evidence that the students were engaged in mathematics as an axiomatic system, as a way of thinking, or as a way of communicating?

Research Questions

1. How did mathematics teachers in the case study schools interact or decline to interact with the Challenge program?
2. Did the mathematics teachers' beliefs about the nature of mathematics influence their participation in the Challenge program?
3. Does infusing rural context (i.e. rural Appalachia) have meaningful impact upon the mathematics instruction and outcomes in rural schools?

Purpose of the Study

The purpose of this study is to investigate whether or not the mathematics curriculum, instruction and achievement were impacted by the Annenberg Rural Challenge in select schools from within an Annenberg Rural Challenge Cluster.

Need for the Study

Research and analysis on rural education needs to expand. Relatively few studies are based entirely on issues in rural settings and little funding is available to conduct research in specifically rural contexts (Sherwood, 2000). A call for mathematics education researchers to focus efforts in rural contexts appeared in an editorial in the *Journal for Research in Mathematics Education* (Silver, 2003). To date, unfortunately, mathematicians and mathematics educators have failed to focus on rural culture with the same enthusiasm and depth as they have taken on issues regarding urban concerns (Silver, 2003). Useful studies will be *meaningful* only if they attend much more carefully to issues embedded in the rural lifeworld (Howley, 2004).

Place-based education has been written about for little more than 10 years; and in that time, several nationally prominent programs have developed and matured. Published accounts of these programs, however, reveal nearly *nothing* about how mathematics is treated in them and no systematic study of these programs' approach to mathematics pedagogy or curriculum has been undertaken to date (Haas & Nachtigal, 1998; Knapp, 1996; Rural school and Community Trust, 2003; Smith, 2002; Theobald, 2000; Woodhouse & Knapp, 2000). This study proposed attempted that for the first time, with the practical intention of helping to cultivate the representation of significant mathematics in place-conscious programming and to facilitate mathematics-conscious

connections in rural communities. Budge (2006) states that there are many references to the potential empowerment that place-based curriculum can have for rural students and communities but “these approaches are only rarely mentioned in the current discourse on standard-based reform.”

This study focused on mathematics education practices in and for rural schools and communities, but was also sensitive to extensions of insights accumulating from this work to other locales. The uniqueness of the Annenberg Rural Challenge revolves around the insistence that all funded projects be organized as cluster schools and networks to specifically enlarge the work around “place”. If a school or district would not adhere to these two requirements, they were not be asked to join the Challenge.

Limitations and Delimitations of the Study

This study focused on descriptive case studies about place-based education. The study is formative and not evaluative in nature. A data base was formed for future comparison and theory building. Although the setting is in rural Appalachia, I did not compare the findings to nonrural and nonAppalachian settings.

Methodology

I used the principles of grounded theory to guide me through data gathering and analysis (Strauss& Corbin, 1990; Hatch, 2002). Data was collected from semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000) with current and former teachers and administrators from the five schools: Copper Basin High School, Ducktown Elementary, Hiwassee Comprehensive School, Van Buren High School, and Woody Gap School.

Included in the design is a series of case studies with a cross-case analysis. Each case will be situated in a small, rural, Appalachian school in Tennessee, North Carolina, or Georgia. The cases are the separate study sites, composed of the place-based program, the school in which it is situated (to the extent of its relationship to the program), the local community (to the extent of its relationship to the program), and the people involved (again, with respect to their relationship to the program)—educators (including technical assistance providers and funders, if knowledgeable about the program), non-parent community members, parents, and former students.

Data was collected through interviews, group or individual, and through surveys of relevant program participants. The interview protocols and surveys aligned with the work of the Appalachian Collaborative Center for Learning, Assessment and Instruction in Mathematics (ACCLAIM). These surveys were of two types: (1) surveys within cases and (2) a cross-case survey that will inform the cross-case analysis. The within-case surveys were developed based on a formative overview of qualitative data collected from each site and on the researchers' experience there.

The cross-case survey were developed specifically to address issues of program dynamics raised in the entire study team's experience and preliminary data analyses, particularly of interview data. The cross-case analysis drew on the themes of individual case reports and on the cross-case survey data.

Data from multiple sources will provide concurrent validity for emergent findings ("triangulation"). Major data sources will likely include the following:

- interview transcripts (teachers, curriculum supervisors, local school administrators, external technical assistance providers, liaisons within funding organizations);
- focus group transcripts (students, parents, community members);
- field notes from observations of instructional events;
- program documents (locally developed at the study sites and those from technical assistance providers and sponsors);
- artifact collection (produced by sponsors, technical assistance providers, schools, teachers, community members, and students); and
- surveys (teachers, students, parents, and perhaps community members)

Summary

The Annenberg Challenge school reform movement was a one time event. It gave certain local educational entities a chance to re-examine their educational beliefs and act on newly formed ideas for change. Particularly, the Rural Challenge stressed school clustering and place-based pedagogy as the way to meet the needs of the rural public schools and their communities. The literature on place-based pedagogy reveals a scattering of methodologies and activities to date. Most place-based pedagogy clearly falls in the mathematics education domain, defining mathematics as a cultural tool for describing rural places and solving rural problems (Bush, 2005). The study of these unique rural clusters of schools that voluntarily embraced the place-based pedagogy of the Rural Challenge has the possibility to broadening the nature and goals of place-based pedagogy as related to mathematics and conceptualizing and conducting research on place-based mathematics pedagogy. Hopefully, this research will assist teachers in

revealing a mathematics that is meaningful and useful to their students and in seeing mathematics embedded in the rural culture.

Chapter II

Literature Review

Introduction

The Annenberg Rural Challenge was established to promote school reform in the rural United States. The initiative was designed to address the nation's concern about student achievement in mathematics and science in rural areas by reconnecting the local community with the school to give relevance and meaning to studies. The Rural Challenge vision of reform was to infuse place-based pedagogy into the curriculum so students would engage in learning activities that address real issues in the rural context and teachers would reflect and share their insights on the lessons taught (Nachtigal, 2000). No assessment is more powerful than having to defend one's research and analysis, written work or mathematical understandings, before a critical audience composed of the local community (Rural Challenge, 1999a). The program designer's hoped to create a dialogue about the purposes of education with the idea that teachers would take the time to examine their personal beliefs about education and how curriculum should be taught. The success of this project depended upon the teacher's interaction with the program. Networking schools together would break the chain of rural teacher isolation and developing pedagogy of place would create unique rural paths to educational achievement for all their students.

Student Achievement

From the launch of *Sputnik* to *A Nation at Risk* (1983), educational performance has been recognized as a national concern, an issue of economic importance as well as national pride. With the passage of the No Child Left Behind (NCLB) law, once again

national attention is focused on the accountability of public schools to produce competent students who can academically compete with the students of the world. Federal, state, and local agencies scramble to seek what they believe to be the educational reforms that will change schools and promote improvements in achievement. These agencies will spend much time and money on researching and implementing the prescribed reforms. But it may not be realistic to believe there will be any progress because, according to Stigler and Hiebert, the U.S. reform road to achievement has been inconstant, misdirected, and ineffectual (Stigler & Hiebert, 1999). Over the past 20 years, achievement scores in mathematics have remained virtually flat, according to the nation's report card on education published by the National Center for Education Statistics (U. S. Department of Education, 2001).

The Third International Mathematics and Science Study (TIMSS) examined the mathematics and science achievement of a half-million students from 41 countries at 4th, 8th and 12th grade. A comparison of U. S. 12th graders' general mathematics and science knowledge to students in 20 other nations in the TIMSS study showed that our students scored below the international average in both topics and exceeded the performance of only two nations. Robert B. Schwartz, Harvard Graduate School of Education, observed, “Now that the 12th grade TIMSS results are out, it is clear that the performance of our schools gets progressively weaker as students move from elementary to middle to high school”(1994). Nationally, large variations in state mathematics achievement persist. The proportion of eighth-graders performing at a Basic or above level ranged from 36 percent in Mississippi to 77 percent in Maine and North Dakota and 78 percent in Iowa (Center for Education Reform and Empower America, 1998).

Clearly, there is a need for higher achievement in mathematics as well as other academic areas. But, as noted above, our history of attempts for reform have not been commendable. Rural educators, in particular, often criticize the use of externally developed comprehensive school reforms because the reforms usually do not address the strengths and needs of rural circumstances (Howley, 1997). Starcher (2002) comments further on this idea,

Generic textbooks designed for the big markets of California and Texas provide for the same homogenized, innutritious diet as all those fast-food places on the strip. The landscape of schooling looks like sprawl America. State-mandated curriculum and high-stakes tests put everything on the same page on the same day and discourage any attention to significant nearby learning opportunities. Education diversity falls prey to the bulldozers of standardization... More and more, we drive a wedge between our children and the tangible beauty of the real world. Moreover, skepticism in the rural community prevails in the belief that the latest reform movement will have any lasting effects. Where have the continuing 'school improvement practices' led us in rural schools? Not very far, it seems.

Most school reforms and structures of the 20th century were not well suited to rural areas even to the point of endangering the survival of rural communities (DeYoung, Howley, Theobald, 1995). As a classic example, Theobald and Curtiss cite the school consolidation movement brought on by the recommendation of James Bryant Conant in 1959 as one of the colossal mistakes of the century leading to large scale community disintegration (Theobald & Curtiss, 2000). Many communities still hesitate to engage in school initiatives because of the potential loss of future social capital (Coleman, 1988) by out-migration of the talented youth to the cities and suburbs (Stern, 1994). The promise of increased academic achievement from consolidation has not materialized nor have substantial financial savings (Sher & Tompkins, 1997; Stern, 1994). Imposed or pre-

packaged reforms have no place in education. Knowledge and curriculum must be invented and translated into practice step by step. Therefore, curriculum should meet the immediate needs of life of a given people (Weva, 2003).

Furthermore, Haas & Nachtigal stress that rural circumstances exert profound influences on schooling that sharply differs from the residents of suburbs and cities (1998). Huber, Howley, & Howley analyzed non-research literature examining mathematics education in rural schools and communities and concluded that there was a real need to “fix” mathematics education in rural schools. They prescribe two major changes. One is a switch from traditional to standards-based curriculum and the other is a switch from “traditional” teaching methods to constructivists’ methods. They also recommend the practice of engaging the local community in decision-making about mathematics curriculum instruction (Huber, Howley, & Howley, 2004). Carter and colleagues (2000) and Bernhardt (1999) would ground curriculum (including “standards-based” curricula) in local culture as the “main catalyst” (Barnhardt, 1999, p.100) for improving the formal education system of rural schools (Huber, Howley, & Howley 2004).

Many educators have reached these conclusions on their own years ago. They have been using a teaching approach called “place-based education” because it holds the potential of resituating learning within the context of communities (Smith, 2002). According to Sobel, “place-based education is not simply a way to integrate the curriculum around a study of place, but a means of inspiring stewardship and an authentic renewal and revitalization of civic life” (2004). Place-based education is not so much a reform but a return to early American educational pedagogy where place was important

for learning and the individual in that place was valuable. Placed-based education, in itself, is engaging rural. Using it implies “that context be allowed to assume equal importance with technical concerns of curriculum and instruction” (Howley, 2002).

Place-based Pedagogy

Place-based education is not new. Comenius, the seventeenth-century education philosopher, articulated one of the core precepts of place-based education when he said, “Knowledge of the nearest things should be acquired first, then that of those farther and farther off” (Sobel, 2004). John Dewey called for changes in schools from which place-based education advocates have drawn ideas. Dewey wrote in *School and Society* (1915),

From the standpoint of the child, the great waste in school comes from his inability to utilize the experiences he gets outside the school in any complete and free way within the school itself; while, on the other hand, he is unable to apply in daily life what he is learning in school. That is the isolation of the school, its isolation from life.

He, also wrote,

Abandon the notion of subject-matter as something fixed and ready-made in itself, outside the child’s experience; cease thinking of the child’s experience as also something hard and fast; see it as something fluent, embryonic, vital; and we realize that the child and the curriculum are simply two limits which define a single process (Dewey, 1902).

Environmental education in the U.S. has long drawn on the principle of connecting schooling to the immediate surroundings of place. Proponents believe that the primary goal of schooling is to prepare people to sustain the cultural and ecological integrity of the places they inhabit (Woodhouse & Knapp, 2000). While Sobel (2004) acknowledged that place-based education is not a silver bullet that will fix all that is wrong with American education, he heralds its strength in accommodating the unique

characteristics of a specific place. Smith (2002) defines it as a “starting point” to help overcome the disconnection between the student and school.

Place-based Education Defined

Place-based education has several varied but basically consistent definitions. Most of the meanings have roots in environmental education. Recently, rural sociologists have commented on the potential empowerment of place-based education and have shared their insights.

Author and educator David Sobel says,

Place-based education is the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science, and other subjects across the curriculum (2004).

Gregory Smith, associate professor of Lewis & Clark College, states,

Place-based education focuses on using local knowledge, phenomena, and experience as the foundation for teaching and learning. Its aim is to connect children and youth more firmly to their own communities and regions (Smith, website).

From University of Iowa College of Education, Robert Yager (2003) declares,

Place-based education makes science, social studies, mathematics, reading, and the humanities more interesting. By integrating place into the school curriculum, learning can be seen as important for daily living: it deals with issues, enables students to participate in societal decisions, and can be related to economic improvement.

The State Environmental Education Roundtable (SEER) says place-based education uses “environment as the integrating context” (EIC) and states this as their definition,

EIC learning is not primarily focused on learning about the environment, nor is it limited to developing environmental awareness. It is about a school using its surroundings and community as a framework within which students can construct their own learning, guided by teachers and administrators using proven educational practices. EIC-based programs typically employ the environment as

the comprehensive focus and framework for learning in all areas: general and disciplinary knowledge: thinking and problem-solving skills: and basic life skills: and basic life skills, such as cooperation and interpersonal communication (Lieberman & Hoody, 1998).

Lieberman and Hoody (1998) studied 40 schools across the U.S. selected by a 12-state consortium known as the State Education and Environmental Roundtable. The schools selected for the study were ones identified as having programs that use the environment as the integrating context for learning (EIC). In addition, 14 of the schools undertook quantitative assessments, comparing the grade point averages and test scores of students in EIC programs with those in traditional learning programs. These schools each collected different types of data, including: comprehensive and subject-matter-specific standardized tests, grade point averages, disciplinary actions, attendance, and student attitude measures. The higher performance of EIC students on standardized tests was particularly remarkable because the programs in which they were enrolled used authentic learning and assessment methods that did not directly prepare students for standardized test formats. Equally striking, the higher performance of EIC students was evident at all grade levels. Besides scoring high on tests, students in these programs had fewer discipline problems, and at-risk students worked better and learned more effectively (Grant, 1998).

David Gruenewald (2003) goes further than the others by establishing a theoretical argument for “place conscious” education. To him, place challenges the homogenizing forces of globalization where you may gain the whole world but lose your own soul (place). He advocates pervasive resistance to educational reforms to prevent knee reaction where the latest fad becomes mandated policy. Place is the antithesis of

abstraction. It is where you live not where you play out theories and untested ideas (Gruenewald & Smith, 2008). Being place conscious provides friction for radical changes that may in the long run hinder student achievement. Place-based education uncovers conflicts and contradictions and probes the community to understand, discuss, and take action. He sees the role of schooling is to produce stewards of a sustainable community (2003).

Critics of place-based education believe that established national and state standards are incompatible with this method of instruction. Some advocates of place-based education do suggest that national and state standards are not as important as the local community needs. Umphrey (1998) states,

No doubt that test scores have their uses, but they are limited uses, and any case we are not going to agree enough about what to do with them to make real changes. Since school finance and governance is a function of state and local governments, there is an obligation to respect their accountability processes, i.e. standardized testing.

To legitimately advocate place-based education these academic standards must be honored. Place-base education and standardized testing could coexist in the same teaching arena. According to Gibbs and Howley, "... place-based pedagogy 'can' establish a practical alliance with mandated standards" (2000). Place-base pedagogy sometimes challenges a tightly focused education standards but it does not oppose a chief aim of the standards movement: providing a high quality education for all students (Weva, 2003). Assessments that are linked to standards and are used to measure students' progress against the standards (not against other students) and give guidance to their teachers can help make the standards effective avoid mediocrity (Rural Challenge Policy Statement, 1999).

Place-based Pedagogy

Place-based pedagogy can take a wide range of forms (Smith, 2002). What follows is a sample the methodologies used by different three programs.

Gregory Smith (2002) summarizes place-based education in five thematic patterns: cultural studies, nature studies, real-world problem solving, internships and entrepreneurial opportunities, and introduction into community process. For Smith the following five common elements of place-based pedagogy must be found: (1) teachers and students turn to phenomena immediately around them as the foundation for curriculum development; (2) there is an emphasis on learning experiences that allow students to become the creators of knowledge rather than consumers of the knowledge of others; (3) students' questions and concerns play a central role in determining what is studied; (4) teachers act as experienced guides, co-learners, and brokers of community resources and learning possibilities; and (5) the wall between school and community becomes much more permeable and is crossed frequently.

According to Smith (2002), for place-based education to work, teachers will have to relax their reliance on academic disciplines as the primary framework for making curriculum decisions, and parents will need to accept more ambiguous measures of student learning that are tied to the completion of projects that integrate rather than separate school subjects. Agencies and organizations outside of the school, including businesses, must come to see themselves as partners in the education of children, and they must be willing to accept interns and provide multiple learning opportunities for younger members of the community. Finally, for place-based education to work well, adults will need to see children as citizens who participate fully in community processes,

and they must make space for their voices and contributions, as well as the time needed to prepare them to use that space effectively.

Place-based education, as practiced by more than 700 schools associated with the Rural School and Community Trust, embraces the following six principles: (1) the school and community actively collaborate to make the local place a good one in which to learn, work, and live; (2) students do sustained academic work that draws upon and contributes to the place in which they live. They practice new skills and responsibilities, serving as scholars, workers, and citizens in their community; (3) schools mirror the democratic values they seek to instill, arranging their resources so that every child is known well and every child's participation, regardless of ability, is needed and wanted; (4) decision-making about the education of the community's children is shared, informed by expertise both in and outside the school; (5) all participants, including teachers, students, and community members, expect excellent effort from each other and review their joint progress regularly and thoughtfully. Multiple measures and public input enlarge assessments of student performance; and (6) the school and community support students, their teachers, and their adult mentors in these new roles (Rural Roots).

East Feliciana Parish School District in Louisiana was created as a result of consolidations, closures, mergers, and chronic poor school performance (Emekauwa, 2004). The 1998-99 school year was the baseline year for school and district accountability. In the following year, 32.6% of East Feliciana's 4th graders scored at the unsatisfactory level in English Language Arts (compared to 19.7% for the state), and 39.0% (28.3% for the state) scored unsatisfactory in mathematics. After seeking out many reform strategies to raise achievement, district officials began implementing a

place-based curriculum supported by The Rural School and Community Trust. Two years after place-based education was introduced the unsatisfactory level in English Language Arts decreased to 18.4%, a full 8.9 points (compared to a 5.5-point decline in the state) from year 1998-99. Similar gains were seen in mathematics where a 14.1-point decline for students who performed at the unsatisfactory level (compared to a 3.6-point decline in the state). The results definitely suggest a testable correlation between place-based education and student academic achievement.

Deb Pierotti, Oak Grove School, Brattleboro, Vermont provides a narrative of her students connecting a mathematical concept within the rural context:

Knitting wove its way into all parts of the curriculum. One student made the connection that knitting was multiplication. "Ms. Pierotti, knitting helps people do multiplication. For example if you had 3 stitches across and 2 stitches down, that would tell you $3 \times 2 = 6$ stitches altogether!" This moment was a turning point. Students chimed in "What's your array?" and soon new shapes took form: rectangles and squares of varying dimensions. I witnessed a classroom full of children making a cognitive leap forward as they built their own bridge from experience to knowing. "I have 5 across and 3 down, so my total number of stitches is 15!! Their discovery became intrinsic knowing, a connection made through their own hands-on experience---"real world" learning. Knitting had captured their concentration and focus, and pulled out of them a solid understanding of a mathematical concept built on their own discovery. The joy that this learning experience brought was an "aha!" moment, the kind of feeling

we all have when we have finally locked into our knowing. Hands working and minds stretching... (Pierotti, 1999).

Ethnomathematics

Place-based pedagogy and ethnomathematics share some characteristics but differ in approach, goals, and origin. PBE mathematics advocates should look at the development of ethnomathematics for guidance in building theory. Bush (2005) relates that ethnomathematics arose from the efforts of mathematics educators based on their beliefs concerning the nature of mathematics, whereas, place-based pedagogy began with a grassroots movement of environmental educators who saw schools being disconnected with the lives of the students in the community. Bush further states,

A comparative analysis of ethnomathematics and place-based pedagogy reveals that ethnomathematics makes broader connections between mathematics and culture than the mathematics applications thus far suggested for place-based pedagogy... several mathematical applications of place-based pedagogy do engage students in projects that help them better understand the circumstances of their community and local environment; others have students use mathematics to solve local problems. While this role of mathematics is critically important and appropriate for rural communities, it fails to take full advantage of mathematics' interaction with culture as illustrated in ethnomathematics literature (2005).

By using ethnomathematics as a model, he suggests expanding research on place-based mathematics pedagogy in rural areas to include using mathematics as the language to describe and address community problems, defining the nature of place-based mathematics pedagogy, empirically analyzing place-based activities that are mathematically rich, and further investigating potential benefits and actual outcomes of place-based pedagogy.

According to Webster, "ethno" is a prefix meaning "nation." Many words begin with ethno. Ethnography is the branch of anthropology that deals with the scientific

description of various racial and cultural groups of people. Ethnology is the branch of anthropology that deals with various racial or cultural groups of ancient or contemporary people, their origin and distribution, and their distinctive characteristics. Ethnocentrism is the practice of regarding one's own race or culture as superior to others. According to Barton (1996),

Ethnomathematics is the field of study which examines the way people from other cultures understand, articulate, and use concepts and practices which are from their culture and which the researcher describes as mathematical.

The study of ethnomathematics is has many people who have contribute to its development. Ascher(1990), Closs(1986), Crump(1990), D'Ambrosio(1990), Gerdes(1991), Njock(1979), Washburn and Crowe(1988), and Zaslavsky(1973) are some of the names of people who have worked in different places of the world to provide insightful and mathematical analyses of a variety of patterns in that area.

The term ethnomathematics was first coined in a 1984 speech by Ubiratan D'Ambrosio to describe the mathematical practices of identifiable cultural groups. D'Ambrosio contributions will be discussed later. Ron Eglash describes it as the study of mathematical concepts in cohesive social groups, with an emphasis on small scale or indigenous cultures.

Marcia Ascher adds to Eglash's description 'with by and large, the indigenous people of the places that were "discovered" and colonized by Europeans.' Joanna Masingila describes it the mathematics of a distinct culture or mathematics in everyday situations. Others describe ethnomathematics as the study of the interactions between mathematics and human culture and proceed to include various sub fields. There are many pre-ethnomathematics names such as multicultural mathematics, indigenous math,

non-western mathematics, and cultural math. Many proponents of ethnomathematics take offense to those names because they think it devalues the real worth of the mathematics of those cultures studied (Smith, 1999; D'Ambrosio, 1991).

Ubiratan D'Ambrosio

We are essentially aiming at the study of the art or technique of explaining, understanding, coping with and managing reality (mathema) in different cultural environments (ethno) (D'Ambrosio, 1991).

To D'Ambrosio, mathematics is more than academic subject; it is his vehicle to channel his passion for global awareness of ethnic prejudice. He stresses that often the values learned are that mathematics is a subject which is a product of Europe and is practiced only by white, middle-class men. In 1991 he stated,

We have ample evidence of the fact that when mathematics programmes in schools all over the world have been associated with European thought, it has been a hinderance to the learning of mathematics by children and adults from diverse cultural backgrounds. Our efforts in education have always had, as a main focus, the intention of raising the level of cultural consciousness and developing self-esteem through the unbiased promotion of the use of diversified modes of coping with, managing and explaining reality.

Fellow Brazilian Paulo Freire inspired D'Ambrosio during a UNESCO project he attended in Mali in 1970. D'Ambrosio made a decision to define ethnomathematics in terms of mathematical practices of any cultural group, rather than specific indigenous societies. The reason behind the context was his desire to have the math world help overcome the colonial legacies that Third World nations had a primitive history of math and thus not important. For D'Ambrosio the movement is nothing less than "a step toward peace" where dignity is restored to the countries dominated by Western civilization. Soon after that meeting a group of mostly American educators organized with D'Ambrosio to found the International Study Group on Ethnomathematics. Math

educators Gloria Gilmer and Rick Scott were co-founders who helped ISGEm sponsor programs and publicize the study of ethnomathematics. In 1990, ISGEm became an affiliate of the National Council of Teachers of Mathematics. Ron Eglash created and maintains a website (www.rpi.edu/~eglash/isgem.htm) that promotes ISGEm causes.

Teacher Beliefs and Educational Reform

Handal and Herrington (2003) stress that curriculum change is a complex process and while many resource and support factors appear to influence change, any successful reform will need to take into account mathematics teachers' beliefs about the intended, the implemented, and the attained curriculum. They further state:

If the mathematics teachers' beliefs are not congruent with the beliefs underpinning an educational reform, then the aftermath of such a mismatch can affect the degree of success of the innovation as well as the teachers' morale and willingness to implement further innovation.

Since teachers' beliefs are related to their practices (Brown & Borko, 1992), conversations about teachers' beliefs should be a part of educational reform in addition to demonstrating activities to try in classrooms. Recognizing that teachers' beliefs are often resistant to change, efforts for educational reform must be long-term and consistent. The research about teacher beliefs will help understand and analyze the data collected concerning the Annenberg Rural Challenge. This research falls into four basic categories: teacher's personal belief systems, teacher beliefs regarding general educational reforms, teacher beliefs about the nature of mathematics, and teacher beliefs in relation to mathematics reform.

Teacher's Personal Beliefs Systems

It is widely recognized that the teachers' personal beliefs and theories play a central role in their teaching practices (Bullough, 1997; Clark & Peterson, 1986; Handal & Herrington, 2003; Kagan, 1992a; Pajares, 1992; Richardson, 1996; Trumbull, 1990). At the classroom level teacher beliefs can facilitate or inhibit curriculum reform (Burkhardt, Fraser & Ridgway, 1990; Koehler & Grouws, 1992; Sosniak, Ethington & Varelas, 1991). Other research findings indicate that teacher beliefs are robust, resistant to change (Block & Hazelip, 1995; Clark, 1998; Kagan, 1992b; Richardson, 1996), serve as filters for new knowledge (Nespor, 1987; Pajares, 1992; Weinstein, 1990) and act as barriers to changes in teaching practices (Fullan & Stegelbauer, 1991; Handal & Herrington, 2003).

Along with attitudes and values, a teacher's beliefs make up what is referred to as a "belief system" (Pajares, 1992). These perspectives are not merely random assortments of beliefs, but ones which seem to cohere and are, in some way connected with each other. Many researchers draw upon Green's (1971) and Rokeach's (1968) concept of belief systems in explaining the relationship between teacher's beliefs and practices use and in examining how an individual's belief's are organized (i.e. Cooney, 1998; Thompson, 1992). Green notes that an individual's belief system is a compound of conscious and unconscious beliefs, hypotheses or expectations, and their combinations. Rokeach (1968) believes that it is not just one belief that determines the way we act but rather a collection of beliefs arranged into a stable, but not necessarily logical, system by the individual. Telese (1997) adds that a combination of teachers' beliefs may be described as a belief system. Cuban (1993) suggests, "The knowledge, beliefs, and

attitudes that teachers have... shape what they choose to do in their classrooms and explain the core of instructional practices that have endured over time."

Since teaching beliefs are a product of personal beliefs and values about knowledge, society, education, and politics (Kagan, 1992b), as well as a process of enculturation and social construction (Pajares, 1992), it may be impossible to separate teaching beliefs from life beliefs.

Moreover, the method a teacher chooses to use in educational situations will reflect his/her own beliefs (Cuban, 1984). Two teachers may have similar knowledge, but teach in very different ways. This would indicate that beliefs are more powerful than knowledge in understanding how teachers make decisions (Ernest, 1989). Consequently, Pajares has called teacher beliefs a "messy construct" (1992). Pajares also notes that beliefs about teaching are well established by the time a student goes to college. What this essentially means is that teacher beliefs or beliefs about teaching are formed early, are difficult to change, and may not be based on rationality nor on the latest educational research. In fact, most research indicates instructional practices, which are essentially behaviors, are a product of beliefs (Pajares, 1992). However, as Ernest (1989) points out, beliefs are more powerful than knowledge in understanding a teacher's pedagogical decisions. Similarly, research has shown that most math teachers, as well as many pre-service teachers, have strongly-held beliefs about teaching and learning, which translates very concretely in views about student and teacher's roles, desirable instructional approaches, students' math knowledge, how students learn, the role and purposes of schools (Thompson, 1992).

Furthermore, Thompson (1992) states that belief systems are dynamic and permeable mental structures that are susceptible to change in light of experience. The relationship between beliefs and practice is also not a simple one-way relationship from belief to practice, but a dynamic two-way relationship in which beliefs are influenced by practical experience. She also states that teachers possess particular beliefs of varying degrees of conviction that develop into their perception about mathematics. Thompson adds that the belief system is organized into components consisting of conscious or unconscious beliefs, concepts, meanings, rules, mental images, and preferences concerning mathematics.

In curriculum decision making, Cornbleth (1990) points out that there is a persistent interplay of contextual influences including teacher beliefs, the condition of classroom teaching, school and district goals and policies, and community milieu. Beliefs “appear to influence both what teachers choose to teach and how they choose to teach it” (Grossman, et al., 1989). Fang (1996), in a review of research on beliefs and practices, synthesized the research on the relationship between beliefs and practice and suggested that beliefs tend to effect behaviors. He also noted that factors outside of the classroom and teacher can also impact practice. Fang’s findings are consistent with other educational researchers, who generally agree that beliefs are connected to actions in the classroom (e.g., Guskey, 1986; Hashweh, 1996; Kang & Wallace, 2004).

Teacher Beliefs about Educational Reform

The Annenberg Rural Challenge was an educational reform movement with the intent of promoting place based education in small rural schools. But as Graham (2002) notes, “education is a complex and diffuse undertaking, embodying a variety of skills and

commitments.” Educational reform movements challenge and make problematic some elements of the beliefs systems held by teachers. Reforms represent change and there is always resistance to change (Dirkx & Spurgin, 1992). One can expect seasoned, experienced teachers, trained within specific disciplines, to bring to a process of educational reform well-established systems of beliefs about what is most worth knowing and how it should be taught. Czerniak and Lumpe (1996) emphasize the need to further examine teacher's beliefs about reform: “Since teachers possess beliefs regarding professional practice and since their beliefs impact their actions, teachers' beliefs may be a crucial change agent in paving the way to reform.” They contend that educational reform essentially depends on the individual teachers’ willingness to change or amend their approach to teaching.

Other studies warn of the inherent problems associated with ignoring classroom teachers' beliefs about reform. Bybee (1993), reflecting upon restructuring science education, emphasizes that the classroom teacher is the decisive component in reforming science education. McLaughlin (1990) found that effective change and program implementation depended more on local factors, such as teachers, rather than federal program guidelines that followed “top-down” methods. Additionally, others stress that teachers must do more than just believe in the reform. Their attitudes towards the reform and their perceptions of the presence of needed support structures and/or barriers to reform are strongly related to their intentions to implement these ideas (Hord, 1988; Valencia & Killian, 1988; McLaughlin, 1990).

Teacher Beliefs about the Nature of Mathematics

Hersch (1986) states that a person's view of teaching and learning mathematics is predicated on the set of assumptions concerning the nature of mathematics held by that person. Numerous studies on beliefs about mathematics teaching have focused primarily on teachers' views of the nature of mathematics (Ernest, 1989; Skemp, 1987; Thompson, 1992). Some research suggests that beliefs about the nature of the subject may be more influential than the mathematical subject knowledge itself (Lerman, 1990; Thompson, 1984).

Skemp (1976) describes the categories of teachers' beliefs about mathematics as either instrumental or relational. Instrumental beliefs about teaching and learning mathematics depends on direct instruction, teaching by telling, and using memorization of rules, formulas, and procedures to solve problems. Relational beliefs about teaching and learning mathematics in this study means the inclination to provide opportunities for students to explore, investigate, use a variety of problem solving strategies, and use prior knowledge to solve problems involving concepts that have not been previously taught.

Thompson (1984) and Ernest (1989) suggest that there are three categories of beliefs about the nature of mathematics: Platonist, instrumentalist, and problem-solving. The Platonist view mathematics as a textbook-driven, unified body of knowledge, emphasizing the discovered, not created relationships and connections across domains and contexts. The teacher is an explainer of knowledge as the student passively receives knowledge. The instrumentalist view is also textbook-driven but consists of an accumulated set of facts, rules, and skills that one applies to a specific set of narrowly defined problems and situations. The teacher is the instructor assisting the student's

acquiescent mastery of those skills and procedures. Furthermore, Ernest (1991) labels the Platonist and instrumentalist as the “absolutist” view of mathematics because both see mathematical knowledge as certain and without flaw. Likewise, Roulet (1998) refers to this view as traditional absolutist. He explains that teachers’ with an absolutist conception of mathematics describe the mathematics subject as a vast collection of fixed and infallible concepts and skills and a useful but unrelated collection of facts and rules (Ernest, 1989). The teachers adhere to the belief that mathematics is an unrelated collection of facts and mathematical knowledge becomes certain and absolute truths. It represents “the unique realm of certain knowledge” (Ernest, 1991, Romberg, 1992). Ernest (1996, p.2), summarizes teachers’ absolutist views about mathematics by saying:

Absolutist views of mathematics are not concerned to ‘describe’ mathematics or mathematical knowledge...Thus mathematical knowledge is timeless...it is superhuman...it is pure isolated which happens to be useful because of its universal validity; it is value-free and culture-free, for the same reason..

Thompson describes the problem-solving view of mathematics as a process of dynamic inquiry focusing on the how and why of concepts and procedures, and is not a set of unquestioned truths to be acquired. The teacher is the “facilitator” of student learning. Ernest (1991) described this view as social constructivist. Roulet (1998) calls this view non-traditional constructivist. He states that a non-traditional constructivist view of mathematics challenges the basic assumption that mathematics is infallible. Hersh (1986, pp. 22-23) lists three main properties of mathematical activity or mathematical knowledge which adhere to constructivist view of mathematics. These properties are:

- Mathematical objects are invented or created by humans.

- They are created, not arbitrarily, but arise from activity with already existing mathematical objects, and from the needs of science and daily life.
- Once created, mathematical objects have properties that are well-determined, and we may have great difficulty discovering, yet they are possessed independently of our knowledge of them.

These teachers see mathematics as continually growing, changing and being revised, as solutions to new problems are explored by the learners with the teachers as “facilitators”.

Teacher Beliefs about Mathematics Education Reforms

In adopting certain models of learning, teachers’ beliefs do have an important role. Brophy and Good (1974) indicate that teachers’ beliefs system are especially important in guiding their instructional decisions. Several studies of mathematics teaching have focused on teachers’ beliefs about mathematics, teaching, and learning while implementing some sort of mathematics reform (Cohen, 1990; Cooney & Shealy, 1997; Lloyd, 1999; Franke, Fennema & Carpenter, 1997). Cohen notes that implementing reform is a tall order for teachers because many of them hold beliefs that are at odds with the core ideas that anchor the reform. Furthermore, Kesler (1985), Parmelee (1992), and Van Zoest, Jones, & Thorton (1984) found that the actions of the teacher are not always consistent with their stated beliefs. This would suggest that a teacher could earnestly think they are implementing a desired mathematics reform without changing their classroom habits at all.

Teachers’ perceptions of the subject matter may also mediate their response to reform proposals. Teachers with “reform” beliefs about the nature of mathematics tend to

engage students in mathematics through problem solving and reasoning, as opposed to having students listen to and watch the teacher solve problems, reason, and communicate about mathematics (Thompson, 1992). While most of the mathematics community has welcomed the apparent success in developing a set of curriculum and evaluation standards (NCTM, 1991), some teachers resent reforms that threaten to deprive them of autonomy over the content to be taught. Grossman and Stodolsky (1995) put forward research that stated mathematics teachers felt significantly less freedom to decide on the content of their classes than teachers of the other four academic subjects. The mathematics teachers commented about the constraints of the content, created by having to cover a well-established curriculum. They also spoke about the sequential nature of learning mathematics. This belief in the linearity of learning inhibited them in the outline of topics taught during the year. Teachers of traditionally well-defined, more sequential subjects such as mathematics may respond cautiously to reforms that could affect the ways in which the curriculum is sequenced for learners.

Grossman and Stodolsky (1995) recommend that educational reform implementation must take into account the role of teachers' existing conceptions of subject matter and how they fit with the intentions of the reform movement. They believed:

that explicit attention to the fit between teachers' existing conceptions and goals regarding subject matter and the subject-matter conceptions of the proposed reforms is needed for successful introduction of educational reforms.

Furthermore, in a study of a British secondary school, Ball (1981) found that mathematics and foreign language teachers were the most resistant to pedagogical change, in part because of their beliefs about the nature of their subject matter. During the

research, the school adopted a mixed-ability organization in the hope of reducing the discipline problems experienced when working with their pupils. Most teachers supported the changes except the mathematics and foreign language teachers. They presented an argument against the reform based on the grounds that their subject matter would not allow changing to a mixed-ability organization. Subsequently they were granted exemption from the change.

The multiple views of the nature of mathematics can be seen within the mathematics community. Those that oppose most current reforms in mathematics education and those that support them tend to hold very different views of the discipline. The “Math Wars” of the 1990’s in California precluded the nation-wide uproar against new “standards-based” reforms (Jackson, 1997a, 1997b). Many of the critics characterized the reform effort as "new-new math," an attempt to link it with the "new math" reform effort of the 1960s, generally viewed by the public as a fiasco. Other critics have called it "fuzzy math", charging that the reform curriculum programs lack mathematical depth and rigor (Klein, 1998). Although these debates are often couched in opposing philosophies of learning—constructivism versus direct instruction, underlying these differences are opposing views of the nature of mathematics.

Standards Reform Movement and Place-Based Education

The recent growing interest in place-based education has come to rural schools at a time when they were being asked to understand and implement standards-based reforms, including state curriculum standards and state-mandated assessments (Jennings, 2005). Budge (2006) states that there are many references to the potential empowerment that place-based curriculum can have for rural students and communities but “these

approaches are only rarely mentioned in the current discourse on standard-based reform.”

Many place-based education advocates and researchers argue these two initiatives are completely incompatible (e.g., Gruenewald 2003; Williams 2003) while others counter that not only are standards complementary to place-based education but they also help legitimize the use of place-based pedagogy (Kannapel, 2000; Jennings, 2005). Jennings (2005), states:

Ultimately this is not a simple story of contending ideas about standards and local forces but rather a complex story of how policy outcomes are shaped by the combination of contending reform ideas, state mandates, teacher beliefs, and local culture.

According to Bush (2005), the current wave of place-based pedagogy arose from a grassroots movement by educators who sought to connect schooling to the lives of students. Gruenewald (2003a) notes the study of place has recently gained attention across a variety of disciplines including architecture, ecology, geography, anthropology, philosophy, sociology, literary theory, psychology, and cultural studies, but as an educational construct, there is thus so far “no single, axiomatic theory of place that might inform educational studies” (Gruenewald, 2003a). With this in mind, Howley (2005) addresses many practitioners’ concerns by examining school programs whose curriculum is engaged in their communities and asks the question, “In what sense does this activity constitute place-based education?” He further states that theorizing place does require judgment and argument about why educators honor what they do. Because place-based education is under-theorized, lacks a universal definition, and simply misunderstood (Gruenewald, 2003a; Howley, 2005; Bush, 2005), presently there is no one final authority concerning the relation of place-based practices and the standards-reform movement.

These differences of what is and is not can be distracting and confusing to a teacher interested in implementing a form of education that honors the local places. The following will explore the differing viewpoints of place-based education advocates who see conflict in curriculum alignment with standards reform and those who see the alignment effort as complementary.

Conflict

A deep concern for rural school advocates is who determines what standards, to what ultimate purpose do they point, and how they are measured (Gibbs and Howley, 2000). The overarching question is, “What is the purpose of schooling?” Education is the responsibility of the whole community, not only of professional educators (Howley, 2004). For these observers, education is all about increasing meanings and connections between community and schooling without “limiting” achievement goals set by external agents such as the state or federal government (Umphey, 2003). The goal is not to limit students to a small core of knowledge, but instead to root a broadly focused curriculum in the day-to-day lives of a community's children (Howley, 2004). This group believes that schools should focus on the needs of the immediate community and use it as the source of content and context. They believe by doing this the students will cover far more curriculum than what minimum standards require (Gruenewald, 2003). These advocates and researchers argue that if there is a demand for greater focus on and accountability for curriculum that is designed for only national and global economic interest, curriculum with a local focus will fade (Kannapel and DeYoung, 1999). For some (Gruenewald, 2003), standards-based reforms stand in conflict to place-based education because standards require a curriculum that is purposefully decontextualized. Others believe that

curriculum and pedagogy should be grounded in the local community context so that students learn how to become productive citizens of their community as well as the larger society (Haas & Nachtigal, 1998). Ironically, while this view focuses on the local there is an acute awareness of the world beyond the community. The local can only exist by developing relationships with its neighbors who might aid or threaten their way of life.

Gruenewald (in Green, 2005) states:

In terms of the meaning of words, standard and place are contrary and conflicting terms. Place is about uniqueness and difference. Standard is about sameness and uniformity. So, on this and other levels I think they are incompatible. The current wave of higher standards, especially in math and science, has been touted as an effort to secure economic dominance in response to the globalized economy.

My issue with what I call “the ritual of alignment” is that it really confuses means and ends. That is, when educators “align” the curriculum they want to develop—whether it’s environmental education, education for social justice, or PBE—with the standards in the content areas, the curriculum becomes an instrumental means to meet the end of the standard, another teaching “method,” at risk, perhaps of being construed as “best practice” for the wrong reasons. As long as the true measure of legitimacy remains the standards and their associated assessments in fragmented content areas like math, place-based pedagogies will be seen as a novel means to the same problematic ends. I have been involved in several of these rituals myself, and I have witnessed the act of aligning curriculum to standards reinforcing the power of the standards and testing to control the minds and work of educators. Greater efficiency in meeting standards and the promise of better test scores are not the purposes of PBE.

The ritual of alignment can also become a huge waste of time—misplaced emphasis that might be better spent on creative teaching, or on reflecting on the purposes of teaching and how poorly many of these are met through content-area standardization.

This viewpoint clearly indicates some researchers and rural education advocates view the inclusion of standards-based standards into the curriculum as a serious threat to the deeply held theoretical purpose of schooling. For them this is not a matter of school reform but a matter of mandating a specific pedagogy as dictated by an outside source for some purpose, such as global economic competition. They see the lessening of the

teaching of the skills within the context of the local community and the devaluing of the need to prepare the students to participate effectively in sustaining the local community.

Complement

Still, another group believes that there is no conflict in using the local funds of knowledge when realigning curriculum to focus on achievement goals, such as Standards-based curriculum (Jennings, 2005). Since 1998, however, there have been numerous exchanges and writings among the rural audience about the feasibility of combining standards-based reform with place-based curricula (AEL, Inc., 2000; Haas, 1999; Jennings, 2000; Kannapel, Coe, Aagaard & Reeves, 1999; Kannapel & DeYoung, 1999; Rural Challenge, 1999a, 1999b).

In 1999, the Rural Challenge issued a policy statement advocating standards that originate in local communities and that are widely shared and understood by all community members. The policy statement goes on to assert that the challenge for the standards movement is not to coax adoption of high standards, but to generate them from within local communities (Rural Challenge, 1999a). They emphasize the context for curriculum and instruction is as important as content. The Rural Challenge policy statement asserts that "Teachers need to teach from the experience of the community to intellectually rigorous standards" (Rural Challenge, 1999a, p. 60).

In another arena, Jennings, Swidler, and Koliba (2005) report:

Vermont place-based and environmental advocates initiated in the late 1990s a process of revision to embed place-based curriculum in the newly created state standards. The place-based revisions are situated in two separate state standards in Vermont's *Framework of Standards* document. These advocates not only saw the state's curricular frameworks as complementary rather than in conflict with place-based education but also as a useful vehicle to legitimize place-based curriculum in schools (p 45).

They continue by noting that rather than railing against or ignoring standards-based reforms, advocates found ways to use standards to enhance and sanction place-based curriculum's legitimate school practice. Advocates deliberately chose to depict place-based curriculum as a pedagogical tool rather than a theoretical construct to avoid confrontation with more traditional education and non-education and therefore legitimately allowable as a part of the state's curricular framework. They also chose to cast place-based curriculum as something valued by a wide range of people, not merely by environmentalists.

Summary

Willard Waller (1932) wrote,

The less discontinuity between the life of the school and the life of the school and the life of the world outside, the better will be the training for life which the school gives its students. Any ideal which cuts down the ability of the school to reproduce reality interferes within its real function of preparing students for life. If schools can "reproduce reality" into their curriculum they stand a chance of giving meaning to the students and the local community.

On this premise the Annenberg Rural Challenge was designed to improve curriculum, teaching and achievement in rural schools. However, many other factors impacted the potential for success and the potential for positive residual effects. Among these factors are a shared understanding of place-based education, a disposition towards pedagogy that allows for flexibility and creativity and a clear understanding of the impact of the belief systems held by teachers.

Chapter III

Theoretical Framework and Methodology

Theoretical Framework

Relatively few scholars are studying rural education issues (Sherwood, 2001). A call for mathematics education researchers to focus efforts in rural contexts appeared in a recent editorial in the *Journal for Research in Mathematics Education* (Silver, 2003). To date, unfortunately, mathematicians and mathematics educators have failed to focus on rural culture with the same enthusiasm and depth as they have taken on issues regarding urban culture, gender, ethnicity, and race (Silver, 2003). Lack of research contributes to inconsistencies among findings from rural education studies (Fan & Chen, 1999).

Consequently, “the information specifically on poor, rural students, communities, and schools is sketchy, lacking in focus, and not comparable across studies” (Khattri, Riley, & Kane, 1997, p.93). The Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) mission is the cultivation of indigenous leadership capacity for the improvement of school mathematics in rural places (ACCLAIM, 2002). ACCLAIM asserts that rural context is as complex, meaningful, and interesting as any other context. Their theoretical framework also states that future research into mathematics education in rural places should elaborate theories of, and knowledge about, “pedagogy of place” for mathematics education in rural schools.

This study investigates a prominent educational reform program, the Annenberg Rural Challenge, which was developed to meet the needs of educational agencies in rural locales. The Rural Challenge was offshoot of the original 1993 Annenberg Challenge. The program offered financial incentives to small rural schools willing to abide by the

Rural Challenge's core beliefs concerning school reform, namely allegiance to the concepts of place-based education and the formation of small school clusters with some uniting trait. Additionally, this study focuses on the experience of schools and communities in coordinating mathematics curriculum with rural community context. My approach is to document the interplay between rural Appalachian mathematics teachers' personal theories and their involvement in the implementation of an educational reform movement, namely place-based education.

The qualitative researcher uses the tools of his or her methodological trade, deploying whatever strategies, methods, or empirical materials as are at hand (Becker, 1989). Creswell (1998) points out that in qualitative research the goal is to achieve, as best as possible, understanding -- what he describes as a deep knowledge of some social setting or phenomenon. Denzin and Lincoln (2000) state, "The qualitative researcher... as a maker of quilts uses the aesthetic and material tools of his or her craft, deploying whatever strategies, methods or empirical materials are at hand" (p. 4). The "choice of research practices depends upon the questions that are asked, and the questions depend on their context" (Nelson et al., 1992, p.2). Merriam (1998) lists characteristics of qualitative research as: 1) the goal of eliciting understanding and meaning, 2) the researcher as the primary instrument of data collection and analysis, 3) the use of field work, 4) an inductive orientation to analysis, and 5) findings that are richly descriptive (p. 11).

A quantitative study primarily looks for comparisons of groups or relationships between variables; a qualitative study allows for exploration of the participants in their own context (Creswell, 1998). Howley and Gunn (2003) state that qualitative researchers understand better the importance of locale than do many quantitative researchers.

Quantitative approaches that focus on select subset of variables necessarily strip from consideration other variables that exist in the context that might, if allowed to exert their effects, greatly alter findings (Denzin and Lincoln, 1998). In this study, context is an underlining theme considered throughout the investigation.

Howley (2003) recommends a postpositivist approach to rural education research. In the positivist approach it is contended that there is a reality out there to be studied, captured, and understood, whereas postpositivists argue that reality can never be fully apprehended, only approximated (Guba, 1990, p. 22). The primary intent of this qualitative study has been to present information concerning a culturally responsive pedagogy for students living in small, rural, southern Appalachia, through a study of Appalachian teachers and administrators attempting to engage in practices that celebrates and acknowledges their local community. A qualitative approach will tease out the story of what was planned, what actually happened, and what is still going on as a result of the reform interventions.

The grounded theory approach (Glaser & Strauss, 1967; Lincoln & Guba, 1985; Mason, 1996; Scott, 1995) refers to collecting and analyzing data simultaneously for the purposes of developing theoretical and thematic explanations, in turn, to explain, compare, and trace the development of the researched phenomena. Grounded theory offers a set of flexible strategies, not rigid prescriptions (Charmaz, 1995). The process involves the following steps: “(a) comparing the data applicable to each conceptual category; (b) integrating the categories and their properties; (c) delimiting the emergent theory; and (d) writing up the theory” (Jorgensen, 1989, p. 113).

Also, grounded theory is a qualitative method used to systematically analyze texts such as interview transcripts to construct theoretical models (Corbin and Strauss, 1990). This is done by carefully reading interview transcripts with specific questions in mind. Glaser (1992) warns about forcing data through preconceived questions, categories, and hypotheses and that warning was honored during the data collection and analysis. Whenever the text suggests an answer to the question, the passage is coded with a key word. By sorting quotes by key words, it is possible to develop an understanding of how different stakeholder groups perceive different phenomena interacting.

Grounded theory, as an ethnographic approach, is used to capture information needed to explicate the interactions between teachers, administrators, and community members who participated in this particular educational reform. Data are narrative reconstructions of experience; they are not the original experience itself (Maines, 1993; Bond, 1990). According to Glaser and Strauss (1967) theories are either deduced from logical assumptions or generated from data. Grounded theory is a qualitative approach that generates theory from data. Grounded theory is more accurately described as a research method in which the theory is developed from the data, rather than the other way around. That makes this an inductive approach, meaning it moves from the specific to the more general.

Key justifications for the use of the grounded theory method include the newness of the investigated phenomena as well as the complexity that pertains to the study of education (Hitt et al., 1998). Also, a grounded theory is durable because it accounts for variation and flexible to allow the researcher to modify the emerging or established

analyses as condition change or further data are gathered (Charmaz, 1995). It is from these attributes of grounded theory I used to inform, refine, and develop my research.

Methodology

In order to tell the story of the TennGaLina Annenberg Rural Challenge cluster and to begin to see what the original intent of the project was, what actually happened, and what the residual effects are, I employed a twofold approach to the inquiry. First, a history was constructed from published artifacts such as end of year reports, portfolios, evaluations, journals, internet articles, and newspapers articles related to the development of the Annenberg Rural Challenge and the implementation of the program following the formation of large statewide networks, the specific program networks, and the small rural clusters. Second, teachers and administrators were interviewed and surveyed using grounded theory as a way to gather rich data (Glaser and Strauss, 1967). These sources guided the start of building ideas inductively, seeing, organizing, and understanding their experiences, and the means to construct a detailed, interpretive time line of what happened.

Setting of Participating Schools and Communities

The description each of the small, rural, Appalachian schools is necessary for future comparisons and investigations in similar projects. The following is the descriptions of the schools and their surrounding communities as presented in the original document for application to the Annenberg Rural Challenge grant:

Three of the schools in the TennGaLina Consortium, Copper Basin High School and Ducktown Elementary School in Tennessee and Hiwassee Dam Union School in North Carolina, are located within eighteen miles of each other.

Before the copper mines closed in 1989, the enrollment of Copper Basin High School was 500; now it is 250 in grades 8-12. Two-thirds of the students

qualify for free or reduced lunches. Twenty-five percent of the current graduating class applied to institutions of higher learning; two joined the armed services. When the mines closed, the dynamics of the community changed because there is no major source of employment in the area. Five years ago, faculty, students, and members of the community recognized a need to reform the curriculum to meet the changing needs of the community. Numerous meetings, extensive self-studies, and prolonged discussions followed. The goals are to increase expectations of the students, to actively involve them in the learning process, and to prepare them for new jobs. To begin the implementation of these goals, general track courses were eliminated, block scheduling was introduced, an advisory program utilizing the homeroom time was begun, and cooperative learning and job shadowing became part of the technical program. Additionally, the school was selected to be a High School That Works site, and this program is presently in its sixth year. The school has also received grants from Appalachian Educational Laboratories, Orion Society, Clemson University's Writing for the Public, Tech Prep Consortium, Levi Strauss, Polk County Historical Society, and 21st Century Classroom.

As part of the curricular reforms, the faculty and students of the school recognize the need for a place-based, environmentally sustainable educational program that can adapt to the changing economic demands. The same process will be used as was used to institute block scheduling. Also, a community advisory committee will be created to assist the school in developing short- and long-range objectives for community planning and economic development, and to create a model for on-going assessment. Also, the school will develop partnerships with local arts organizations, the mining museum, local businesses, and the Cherokee National Forest. Staff development workshops are being planned to incorporate local heritage and environmental studies into the curriculum, to accommodate the different learning styles (i.e. Gardner), to implement writing across the curriculum, and to develop art and ecological activities for all subjects. In the future, Copper Basin High School hopes to become a center for ecological study because the Basin offers examples of all degrees of environmental degradation and reclamation. Also, the school plans to coordinate its environmental studies with those of the Green Gold Conservancy at Ducktown. Finally, the school plans to align its local curricular mandate with those of the state.

Ducktown Elementary School was built in 1933 for a college that was never certified and was placed on the National Registry of Historic Buildings in 1993. The town of Ducktown, in the Copper Basin, is in eastern Polk County, the southeastern most county in Tennessee. The copper mines opened in 1850 and closed in 1989 with the loss of 2500 jobs and much of the population of the Basin. Currently, the population is 5000 and the unemployment rate is twelve percent. The enrollment of the school is 270 students in pre-school through seventh grade. Seventy percent of the students qualify for free and reduced lunches. Ducktown is one of two elementary schools in the Basin and is a feeder school for Copper Basin High School. The school's mission is to preserve the integrity of the

community and its heritage by developing a placed-based curriculum. In 1990, Ducktown faculty began the implementation of this mission with the establishment of the Green Gold Conservancy on the school's 160-acre campus. Its goal is to foster stewardship of the community's environmental resources. The conservancy consists of three trails, ten separate habitat areas, and numerous outdoor teaching spaces and interpretative trail markers, all created by students and community members. Students work with a community advisory board which sets goals and assesses the projects. However, the students direct and carry out the work on these projects. They have constructed and erected birdhouses, cleared trails, studied flora and fauna native to the campus, identified a salamander nursery, and learned the importance of stabilizing and preserving the endangered cranberry flood plain. (The conservancy is home to the southernmost naturally occurring cranberry bogs in the United States). The conservancy has developed a working partnership with thirteen area conservation, government, and service agencies and organizations. As a result of the conservancy's accomplishments, the school has received state-wide recognition.

Encouraged by these accomplishments, the faculty wants to expand the curriculum to embrace local heritage using the process modal established by the Green Gold Conservancy. A community advisory board will assist students and faculty members in designing this program. In addition, local artisans, crafts persons, storytellers, and musicians will be an integral part of the instructional process. The goal is to incorporate Native American and Appalachian heritage in all grades and all subjects. Social studies classes will learn local history and heritage; music, dance, drama, and crafts will become part of the learning process; and the language arts classes will include regional literature and the art of storytelling.

Hiwassee Dam was established in 1937 to educate children of local residents and construction workers building TVA dams in the area. The school shares its campus with the Hiwassee Dam Community club and the volunteer fire department. It is part of the Cherokee County, North Carolina school system and is located about sixteen miles west of Murphy, the county seat. It is one of the last "union" (K-12) schools in the state and has an enrollment of 425 students. The school's population has leveled off after declining by a third since the shutdown of the mining operations in neighboring Polk County, Tennessee a decade ago. About sixty percent of the students at Hiwassee Dam qualify for free and reduced lunches, and about seventy percent of the graduates go to institutions of higher learning. Of these, most receive some form of financial aid. Also, new people are moving into the community and driving to work elsewhere, in large part so that their children can go to school in a "safe" rural environment. Now the parents of about half the children currently attending Hiwassee Dam did not grow up in the community.

The philosophy of Hiwassee Dam Union School states that students learn in many different ways (i.e. Gardner), that traditional methods are inadequate for the needs of many students, and that nonacademic skills and ways of learning and knowing are undervalued in the standard curriculum. To implement the school's

philosophy, the faculty, students, and members of the community are developing a curriculum to include interdisciplinary teaching and community-connected learning. They are using local and regional colleges, universities, art councils, state and federal forest services, TVA, and numerous other resources to develop and to sustain a nature trail, an outdoor classroom, a wetlands area, and a recycling station. They are also providing opportunities for the students to learn about and to participate in various arts, crafts, and cultural programs. The Kennan Institute granted a five-year “A+” status to the school for the integration of arts and academics. Now in its third year, the program has been well received by the community. Encouraged by the success of these programs, the faculty has set new goals: to devise a curriculum that will ensure the continuation of the rural economy and culture, to explore ways to integrate the influx of tourism with the culture of the region, to utilize community resources and people in educating the students, to develop a program that will become self-sustaining, and to incorporate the goals, skills, and philosophy of the “A+” program into a cultural preservation process. The school also needs a focal point for its integrated curriculum and a place to exhibit students’ work. Recognizing this need, the students, the faculty, and the community are discussing the possibility of constructing a building to house a permanent gallery and an outdoor theatre. It will be a place where the community can gather for public meetings; a place for local artisans and crafts persons to conduct workshops and exhibit their work; and a place where students can participate in plays, in musicals, and in dramas. The conception, construction, and program design of the center will be done by students and by the community with school faculty extracting courses and lessons from the work being done. The students will also use computer technology and the internet to advertise their arts and crafts and their co-sponsors. Together the community and school at Hiwassee Dam, North Carolina will create a sustainable, ongoing, relevant educational process that preserves the past, energizes the present, and inspires the future.

Because of their isolation, all of the schools in the TennGaLina Consortium have avoided consolidation with larger county schools except Van Buren County High School. This school, located in the county seat of Spencer, is the only secondary school in Van Buren County, which has the third smallest county population in the state of Tennessee. Spencer is located on the Cumberland Plateau roughly in the center of a triangle formed by Nashville, Knoxville, and Chattanooga. The population of the county is relatively stable. In any given year withdrawals and new entries in the school will only run about two percent. Most of the residents come from families which have been in Van Buren County since pioneer days; the total population, white Protestant, has changed little since the 1850 census. The school serves 460 students in grades six through twelve. Seventy percent of these students qualify for free lunches. Nearly seventy percent of the county’s land belongs to two absentee landlords, both large corporations. Almost all of the county is covered by forest. Fall Creek Falls State Park, the largest state park in Tennessee, is in Van Buren County and its neighboring county, Bledsoe.

Van Buren High School's mission statement emphasizes interdisciplinary teaching and community-connected learning. An example is writing across the curriculum which incorporates local heritage education in all disciplines of the school. Another example is the horticultural program. Because the area nursery industry is one of the largest in the world, it provides opportunities for future employment for the school's graduates. Responding to this need, the school introduced a horticulture program and built a green house to incorporate learning in all academic areas while studying native plants and wildflowers. As a result of the community's interest in this program, one of the large land companies in the county is dedicating property so that students can grow and study native plants. Another benefit of the horticulture program is the development of a relationship between the school and Fall Creek Falls to discuss a possible partnership with the park's expert staff and the school's horticulture program. The Goal of this partnership is to involve students in a project to reintroduce native plants to the grounds of the Fall Creek Falls State Park nature center. Another aspect of the horticulture program is an on-going discussion in the classroom of environmental issues such as how clear-cutting timber affects the local environment and how strip mining impacts the Fall Creek Falls watershed. Students consider the issues of good stewardship of the land, of conflicting economic needs of various segments of the community, of the responsibility of good citizenship, and of the necessity to plan for sustainable environmental programs. Finally, the biggest project for the school and the community will be the creation of the Daisy Rinehart Plateau Life Museum. The heirs of Ms. Rinehart have agreed to give her home and its furnishings to the Van Buren High School Education Foundation to function as a center of activity where the school and the community may meet to share work, ideas, and experiences. Students will landscape the grounds to display the native plants and wild flowers; they will assist in the restoration and decoration of the house; and they will learn how to renovate historical sites and artifacts. These projects will utilize the knowledge, skills, and talents of local artisans and horticulturalists.

Woody Gap in Suches, Georgia is the last public K-12 institution and the smallest public school in the state. The school has an enrollment of ninety-one students and a faculty of fifteen making the pupil-teacher ratio seven to one. This school escaped consolidation with other schools in Union County, because residents of the community have a forty minute drive down a narrow, twisting road to Blairsville, the county seat. This lack of accessibility has helped to maintain a rural way of life in the area. Many of the students come from families who have lived in these mountains for several generations. Much of the area is national forest or state wildlife management land. Most of the parents work for the forest service or in construction and manufacturing positions that require them to leave the community. But to the people of Suches, preservation of the community is the citizens' responsibility. They built a Neighborhood Health Center and a fire hall with the help of grants; they volunteer to serve the Suches Fire and Rescue program; and they organized a recreation association and applied for and received grants to build ball fields and tennis courts. These residents are

convinced that the survival of the community of Suches depends on the continued existence of Woody Gap School and have made a strong commitment to support it. They stage an Indian Summer Festival each fall to raise money for the school's needs. This includes building an outdoor stage, a weight room, and a concession building; providing scholarships; and supporting both the sports and the academic programs. The parent-teacher-student organization raised more than \$20,000 to buy the school's first computers, and then the school offered a course in computer use to the community residents. A local resident gave \$10,000 to purchase science equipment for grades K-12. Suches volunteer fire department provides the school with substitute teachers, and individuals within the community often volunteer their time to read to the elementary and middle school students.

Like Hiwassee Dam, the community of Suches needs a community center/school media center. To accomplish this, the residents have become political activists. They have met with the local school board, the superintendent of schools, and their state representative. Woody Gap School is an essential partner in the success of this project. The community mandate to the school is that a vocational emphasis needs to be added to the curriculum. The goal is for students and teachers to discover new ways of teaching and learning in hands-on, rurally based, vocational activities by initiating the use of community and regional resources. Students will learn the elements of construction ranging from architecture and design to actually building the center. They will learn how to frame, plumb, lay blocks and bricks, wire and roof. Local artisans and craftsmen will work as consultants with the teachers and students to develop a process of teaching and learning that is relevant to the community's needs. Volunteerism among community members will be encouraged, and donations of materials will be needed. To further encourage community participation, this community/media center will become a place where local artisans and craftsmen can share their knowledge and skills with the students and faculty, a place where their skills not only build but sustain a community, and a place where students can be productive citizens of their community. This vision shared by Woody Gap School and Suches community exemplifies the motto of the TennGaLina Consortium; 'Weaving the past together with the present for the future.'

Participants for Interviews and Surveys

From the literature published by the Annenberg Institute and the TennGaLina rural cluster, key players were identified as school administrators who were involved in the recruitment and initial planning of the Annenberg Rural Challenge and teachers who taught mathematics at the various schools during the implementation of the project.

These potential participants were contacted by letter, telephone, email, or other personal

inquiry. They were asked to participate with the understanding that their identity would be kept anonymous throughout the report and there would be no compensation for participation. Most of these people were no longer with their original TennGaLina schools and some had retired from the educational field. Also, the purposeful sampling of participants was hampered by the small pool of people to select from each category due to the actuality that in small, rural, isolated, Appalachian schools the academic department may consist of just one staff member.

Once given an indication of interest in taking part in the study, I sent to the potential participant review materials of selected TennGaLina publications and articles generated during the project (Appendix C). Current principals of the schools involved were contacted and permission to use the facilities for interviews was secured. Participants were contacted and interviews were scheduled and many times rescheduled to fit their needs. Some participants requested and were given a preliminary outline of the questions that might be asked during the interview (Appendix D)

Data Collection

The data were collected over a period of twelve months i.e., from June, 2007 to May, 2008. This project made use of four methods of data collection attributed to grounded theory: interviews, surveys, artifact collection, and researcher introspection. Interviews were conducted at a time and place convenient to the participant. An interview lasted no longer than sixty minutes. Most mathematics teachers completed the Beliefs Survey (Appendix A) within the interview time period. One teacher faxed the survey at a later date. All four administrators completed a cross-case study survey (Appendix B).

The initial planners of the TennGaLina were charged with submitting a document outlining an initial summary of objectives and preliminary budget for the three-years of funding by Annenberg Rural Challenge. The “Initial Budget Proposal” was the guide for aligning activities proposed for funding during the implementation phase. A team of evaluators from Strom Thurman Institute, located on the campus of Clemson University, were contracted to produce documents summarizing the yearly activities of each TennGaLina cluster site. The evaluation team produced three documents: “Year-End Evaluation Report June, 1998-August, 1999”, “Rural Challenge Mars Hill Conference on Place-Based Education (dated June 7-9, 1999)”, “Year 3 Final Evaluation Report for the TennGaLina Consortium Rural School and Community Trust Project (dated August 1, 2000).” These documents were analyzed and contributed to this report.

The eight interviews were conducted using a semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000). Four administrators were interviewed who were either involved in initial start of ARC program or involved in the implementation of ARC program and four mathematics teachers who were teaching at one of the schools involved during the implementation of the ARC. The administrators were asked questions pertaining to the initiation of the program with a particular focus concerning involvement of any mathematics personnel. The mathematics teachers were asked to reflect on their experiences working in ARC and how their beliefs about the nature of mathematics might have influenced their participation.

Data Analysis

The data were analyzed using the methods of grounded theory (Glaser & Strauss, 1967) and grounded interpretivism (Addison, 1989), as the larger project attempts to

build a theory of how teachers and administrators attempted to engage in place-based practices involving mathematics that celebrates and acknowledges their local community. Grounded theory and interpretive research methods are both constant comparative methods in which the researcher is constantly looking for and questioning "gaps, omissions, inconsistencies, misunderstandings, and not-yet understandings" (Addison, 1989, p. 41). Both methods also emphasize the importance of context and social structures in research settings, and in both methods data collection, coding, and analysis continue throughout the research process.

I used line-by-line qualitative methods of coding data as a "progressive process of sorting and defining and defining and sorting" (Glesne, 1999, p. 135). Data was collected from semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000) with current and former teachers and administrators from the five schools: Copper Basin High School, Ducktown Elementary, Hiwassee Comprehensive School, Van Buren High School, and Woody Gap School. A professional transcriptionist transcribed each interview into a computer software document. I read each interview looking for themes and categories and identified the major domains, based on a rereading of the data, and assigning each a code. As data collection continued, these steps were 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 support 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 reread the data selecting quotes to support my findings and included them in the outline (**Appendix F**). I collected

source material including project work, lesson plans, etc. from former students, teachers, and administrators. I checked newspaper files from the period for any relevant stories about the Rural Challenge and analyzed and reviewed with respect to the established domains. I surveyed the people involved, the teachers, administrators and any support personnel that may have been identified as a key participant.

Included in the design is a series of case studies with a cross-case analysis. Each case is situated in a small, rural, Appalachian school in Tennessee, North Carolina, or Georgia. The cases are the separate study sites, composed of the place-based program, the school in which it is situated (to the extent of its relationship to the program), the local community (to the extent of its relationship to the program), and the people involved (again, with respect to their relationship to the program) — the teachers, administrators and any support personnel.

Surveys were used to collect additional data. These surveys were of two types: (1) surveys within cases (Appendix A) and (2) a cross-case survey that will inform the cross-case analysis (Appendix B). The within-case surveys were developed based on a formative overview of qualitative data collected from each site and on the researchers' experience there.

The cross-case survey was developed specifically to address issues of program dynamics raised in my experience and preliminary data analyses, particularly of interview data. The cross-case analysis drew on the themes of individual case reports and on the cross-case survey data.

Data from multiple sources provided concurrent validity for emergent findings (“triangulation”). Major data sources included the following:

- interview transcripts (teachers, administrators, support personnel);
- program documents (locally developed at the study sites and those from technical assistance providers and sponsors);
- artifact collection (produced by sponsors, technical assistance providers, schools, teachers, community members, and students); and
- surveys (teachers, students, parents, and support personnel).

After compiling the survey data, I again analyzed and reviewed the data with respect to the established domains adjusting the outline as the data requires. This triangulation confirmed the domains and finalized the outline. From this outline, I describe the findings.

Limitations of Data Collection

The scope of this study did not include actual observance of classroom activities because many of the teachers involved in the original Annenberg Rural Challenge are no longer at those schools. Again, grounded theory methods allow for reconstructions of experiences although the data collected is not the original experience itself (Bond, 1990; Maines, 1993). In order to describe the mathematics teachers' beliefs about the nature of mathematics in this study, I selected an established quantitative survey called the *Mathematical Beliefs Survey System* (Yackel, 1984) to help in the analysis. Questions in the survey are written in an effort to determine if the teacher tends to favor beliefs based on instrumental understanding or if they tend to favor beliefs based on relational understanding of mathematics (Skemp, 1976). Therefore, it should be noted that what is called beliefs in this study may be called espoused or claimed beliefs because they are based exclusively on written and verbal responses to specific questions.

The Beliefs Survey was designed on a five-point value scale and used to examine the beliefs about mathematics held by prospective elementary teachers. The survey instrument was developed by Yackel (1984) to determine the expressed beliefs of college students at Purdue University about mathematics, and to measure how likely they are to favor rule following (instrumental understanding) versus reasoning (relational understanding). Yackel (1984) based the design of her instrument, Beliefs Survey, on the long-time research of Skemp (1976). Skemp (1976) defines and compares mathematics beliefs expressed by “relational” learners to those beliefs expressed by “instrumental” learners. For the relational learner, mathematics involves more than memorizing and knowledge is constructed based on what has been previously learned. Problems are solved through the use of alternatives and not just reproducing an algorithm. Learners take responsibility for their own learning, not just getting the right answer. Instrumental learners believe mathematics is a system driven by rules and procedures that must be memorized, that rules and procedures can be plugged into problems and the “right answer” can be found (Carter & Yackel, 1989).

Yackel (1984) notes some of the responses “seemed” inconsistent, students might indicate that they believed that mathematics should make sense, but also believed that it is about rules and procedures. She believes that students who respond in this way really want math to make sense, but the use of rules and procedures is what “mathematics is to them” in their experience. She used the survey instrument primarily as a way to develop a better understanding of students who were enrolled in her undergraduate mathematics classes. She used the survey with many different groups of students and found the results to be very similar between groups. These observations led her to conclude that the

instrument did identify the beliefs stated by the prospective teachers. A Reliability Analysis was constructed for the data collected for this study to determine the strength of the Alpha.

The Beliefs Survey 5-point scale is as follows: 1-2 – relational, 2-3 – somewhat relational, 3-4 – somewhat instrumental, 4-5 – instrumental. Since only four people took the Belief Survey in this project, the researcher relied on the data of a similar study (Quillen, 2004) that used the Beliefs Survey yet had a substantially larger data base.

Interpretation of Data

Beliefs act as a filter through which teachers make their decisions rather than just relying on their pedagogical knowledge or curriculum guidelines (Clark & Peterson, 1986). According to Handel and Herrington (2003), these beliefs are forceful enough to aid or impede the implementation of any educational reform. Implementing place-based practices would necessarily mean to recontextualize the classroom curriculum.

Instrumental learners believe mathematics is a system driven by rules and procedures that must be memorized, that rules and procedures can be plugged into problems and the “right answer” can be found (Carter & Yackel, 1989). If a teacher were instrumental then there would be less likely to embrace a reform such as place-based education.

Quillen (2004) stated that in correlational research, skewness is defined as a lack of symmetry in a frequency distribution. Distribution with a long “tail” to the right will have a positive skew and a long “tail” to the left will have a negative skew. Kurtosis is defined as the measure of whether the peak of the distribution is taller or shorter than the ideal normal curve and also whether the tails are higher or lower than the normal curve.

Very peaked curves have a positive kurtosis. If a large (plus or minus) skewness and/or kurtosis are found to exist, relative to the standard error, it is said to deviates from normality. The skewness and kurtosis statistics were divided by their standard error, and in each category it was found to be approximately 2.5 or less, thereby, supporting the assumption of approximate normal distribution.

A two-tailed test was used for all correlations because it was not certain if positive or negative correlation would be found, particularly those involving the Beliefs Survey because of the direction in which the questions were written. A frequency distribution and a histogram was constructed for the Beliefs Survey, the mean score for the Beliefs Survey was 2.8, standard deviation = .567, skewness = .888, standard error of skewness = .393, kurtosis = -.114, and standard error of kurtosis = .768. Skewness or kurtosis was not significantly different from normal. The histogram was approximately normally distributed.

Quillen constructed a measure of reliability analysis scale (Alpha) to determine the internal consistency reliability of the instrument. The inter-item correlation for four items, 13, 15, 16, and 19 was found to be low and did not fit well into the scale psychometrically. These four items were deleted, leaving the Beliefs Survey a 16-item document. Also, the scores for item numbers 3, 8, and 9 were reversed because they were worded to measure positive relational beliefs and all the other questions were worded to measure positive instrumental beliefs. It was necessary to have all responses worded in the same direction. The scores of the respondents to the items were averaged and entered as a summed score under the new variable Beliefs Average. The Alpha for the revised 16-

item document was 0.89. The strong alpha indicated strong reliability of the Beliefs Survey. These guidelines were used in this study.

Chapter IV

Data

This study investigated whether or not the mathematics curriculum, instruction and achievement were impacted by the Annenberg Rural Challenge in select schools from within an Annenberg Rural Challenge Cluster. The purpose of this study was to investigate the following questions:

1. How did mathematics teachers in the case study schools interact or decline to interact with the Challenge program?
2. Did the mathematics teachers' beliefs about the nature of mathematics dissuade (influence?) their participation in the Challenge program?
3. Does infusing rural context (i.e. rural Appalachia) have meaningful impact upon the mathematics instruction and outcomes in rural schools?

The results of the investigation were determined from interviews, artifacts, and surveys.

Interview Data

Themes that investigate how place-based curriculum was developed and matured in the TennGaLina Rural cluster are: the original intent, the actual implementation, and the residual effects of the program. Eight interviews were conducted using a semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000).

Original Intent

In 1995, the Annenberg Rural Challenge was established to promote school reform in the rural United States. The founding board members were convinced that traditional approaches of reform based on the industrial model of education did not benefit rural schools. The Rural Challenge's vision of reform was open-ended, holistic,

grassroots in nature. They stressed placed-based education with five themes: local culture and history, ecology, local economy, entrepreneurship, and civic engagement. They hired “scouts” to find groups of communities in rural America who could make proposals and do work congruent to the Challenge’s approach. A scout was assigned to the Appalachian area to find “genuinely good, genuinely rural” schools interested in working with other similar schools to integrate the community in the K-12 community. The scouts were told to find groups of communities very interested in building on local assets and capacity while sharing ideas and resources to sustain one another. These groups of communities were called clusters.

Only one mathematics teacher was involved in the original planning. She provided an interesting account of how the initial contacts concerned specific capitals need of the school rather than a broader vision of educational reform. The idea of being a part of a cluster of schools had not set in. According to the teacher involved in the initial planning:

Our principal, at the time, had worked with a couple of folks on staff and they wrote a grant or wrote a proposal to the Rural Challenge because we were invited to apply, as best I recollect. And the proposal was to have the kids to learn about building. We needed a library at the time so their proposal was to take the community members to help the kids to build a library. So that was the original proposal that they sent in to the ARC scout. So he came and I remember having a meeting with him and the community. We had several community members in the auditorium and he was talking about what the Rural Challenge was about and the community members had several questions about that. But I think they abandoned that first initial proposal pretty quick once they got it approved. And our administration had changed, it went to another person, but the direction of the grant changed at that time, the principal had asked me to go to South Dakota with a couple of students to the national convention -- I don't remember what it was called, extravaganza or something. And it was about placed-based education and having the kids learn. And the kids at different schools, they were very similar to Woody Gap, very small, were doing these neat projects and learning their curriculum through these projects of placed-based education. Everybody was

different, but it was the same because they were using that. They defined it because that's where we first got the ideas to do -- we were doing that here anyway at Woody Gap, but we weren't sure exactly what we were doing. Some teachers had started the Old Fashion Day here and that's what we were doing was taking some of the heritage of the area and the community members to come in and teach the kids. And in that, the kids were writing about it and using that as their curriculum for English and history and different things so that we were doing it, we just didn't have it to the extent that the others were.

More talks with the Annenberg scout helped the schools understand the intent of the project. A founding administrator commented about the beginning of the TennGaLina cluster:

We first met with a scout for ARC. Next, we tried to formulate a community agreement of what things were important. Then we formed coalitions to apply for the ARC grant. The project was introduced to the school through training of teachers to consider all things taught through the eyes of the place in which they lived.

The initial proposal training would include what was at first called site based curriculum. Site based curriculum was not defined in the original proposal. The Initial Budget Proposal lists “curriculum alignment” as core expenditure for each member of the cluster. Interviews of both teachers and administrators revealed the need to show accountability for any changes in school curriculum. Site based curriculum alignment would assure them that the materials taught in the classroom would match the standards and assessments set by the State for each grade level and subject areas. The vastness of this task was viewed as overwhelming to teachers who struggle to find enough time to complete routine duties. So rather than undertaking curriculum alignment on their own, the initial planners of the grant justified the need and the cost of outside help to orchestrate curriculum alignment. The Institute at Mars Hill College was hired for completing that task.

Some of the people saw the Annenberg Rural Challenge as a means to provide resources for expansion for what they were already doing. They felt that this was an opportunity for their schools to analyze, refine, record, and share their current curriculum.

This view was expressed in another school official's comments:

The initial intent was to use place-based education as a spring board from which to involve the community in the educational process. The Annenberg money would serve as seed money to stimulate the early stages of the process. Once the process was fully implemented, community response would drive local schools to fund this type of education. The school would act as a resource for the community rather than the community as a resource for the school.

Leaders of other clusters saw the chance utilize the Rural Challenge to explore the notion of integrated or cross-curriculum education. Copper Basin High School's original intent was to use art across the curriculum to develop a model of curriculum integration to be used in later initiatives. A lead teacher told the interviewer:

In the very beginning, I was told that we were incorporating arts across the curriculum through visual learning and that's how it started off. It really became apparent that the place based was a big part of what we were trying to do so I turned my attention more towards how the arts could be used in that since art is what I do. And from that point on, things changed in how I approached everything. It was still arts across the curriculum, but it began to be through place rather than just generalized.

Also, the initial plan in most schools required staff members to attend in-service meetings that explained the purpose of the Rural Challenge. But the teachers were not coerced into participation in any further Rural Challenge projects. Participation was optional. As one principal explained:

All teachers were required to take the workshop training, and were paid stipends to participate, but were not required to incorporate the community based activities into their particular classrooms. The response was that about ½ of the faculty did participate, and ½ did not. Some felt that the pressure to "teach to the test" was too great to try something new.

Specific areas of interest addressed by all cluster schools were heritage, environment, and sustainability. Various disciplines would be expected to integrate their curriculum around these areas. The activities generated would be collected and place in a site's portfolio.

The cluster was to develop means to communicate with each other. "Networking" would include site-wide workshops, attending national Rural Challenge meetings, and building a website to share information. The portfolios were to be shared with other members of the cluster and to outsiders who might be interested in what they were doing.

Implementation

The initial year of the Annenberg Rural Challenge was spent searching local sites for opportunities to connect community and schools. Some of the sites continued with projects they had begun before the Rural Challenge, analyzing, refining and documenting the work. Other sites developed programs that fit their vision of place-based education. Mars Hill College worked with the cluster to flesh out what they would define as place-based education. And teachers of the various disciplines participated to the program to the degree that they felt they could.

Mars Hill College led the community audits and strategic planning for each school site and community. The first major cluster conference meeting was at Fall Creek Falls State Park in August of 1998. At this meeting, Mars Hill College staff presented initial information generated by the community audits, including demographic information. The groups of teachers broke into smaller groups and talked about how their school's vision of the Rural Challenge. The participants came back together and

discussed common goals that the schools could incorporate into the strategic plan. One teacher who attended recalled her account of the conference:

An important part of this conference was to getting to meet teachers from the other schools. Many of us were uncertain what was expected of us by the national and local evaluators of the program. We were initially told to continue what we were doing but document things and turn in the activities the media specialist. I left the conference feeling a little bit better about what I was doing but I knew that Mars Hill or one of the other teachers needed to help me understand more about the program.

Funding for the first year of the program was delayed by the national office and sites had to wait six months for distribution. Some teachers made commented: “I was reluctant to start a project the first because we were expected to implement projects with the promise of reimbursements later. I did get reimbursed but that first year I was uneasy about the money situation.”

Hiwassee Dam continued the A+ Program that they had started before the Rural Challenge. North Carolina’s Department of Education supported the program’s effort to provide students with a cross-disciplinary curriculum. Many of the A+ Program’s activities were project-oriented and activity-based learning. They were also continuing their Appalachian Studies and participating in the REAL program. The REAL program is one of the Annenberg state-wide specific programs that assist the clusters around a specific theme. REAL worked with Hiwassee Dam on entrepreneurships with small businesses. Van Buren County School continued engaging the school and community by participating in the Junior Beekeepers Club. They consulted with local beekeepers in

maintaining a hive on school grounds. A school administrator commented about continuing programs:

The schools continued to do what they were doing and documented, but with the Annenberg funding, we were able to expand the community involvement by being able to attract local experts into the curricula by offering stipends and expense money that had not been available before. We were able to share and use our neighboring school's expertise to broaden the resources in our teaching arsenal. We did conduct workshops where "experts" were invited in to teach integration of the community resources into the teaching models.

Copper Basin, Ducktown Elementary, and Woody Gap added programs that they felt best represented place-based education efforts. Copper Basin and Ducktown established arts across the curriculum as a model of implementing cross-curriculum instruction. Teachers were shown how art can be used with subject areas and how they might collaborate on projects with other teachers. They later used the model to implement environmental studies across the curriculum. Ducktown continued with an established environmental study but also added an exploratory period to the schedule. The new exploratory period allowed the school and community to work together to provide open-ended, hands-on, and often place-based activities. The bluegrass music program was one of the most ambitious parts as well as a quilting class. Woody Gap continued programs inspired by the Foxfire curriculum but added heritage gardening and programs concerning construction projects. Woody Gap was undergoing many building projects at that time. According to one teacher who was reflecting on a lesson combining geometry and the building of a heritage barn:

Rotations, reflections, Pythagorean Theorem, we do parallel lines. I mean, there's a lot of geometry in there and they use a Geometry Sketch Pad in order to help discern that.”

In the second year of the program key leaders of the initial start up of the Rural Challenge were no longer with the program due to retirement or resignation. Many of the teachers expressed concerns of support when some of the new principals involved did not take an active role in the leadership. This issue was addressed at year end conference conducted by Mars Hill College. Curriculum specialists presented the group with ways to reach their TennGaLina goals through curriculum development. Teachers were shown how to design cross-curriculum projects together based on a focus of the cluster such as environmental studies. This was Mars Hill’s idea of how to develop a place-based unit. Many teachers adopted this method of participation and contributed their activities to the document, *Rural Challenge Mars Hill Conference on Place-Based Education*. The teacher and administrator turnover rate did create a major conflict for the schools. One teacher shared this observation: “There was turnover, but no training for the new staff so the program was not sustained.”

Involvement in the Rural Challenge was not mandatory. Many teachers choose not to participate in the program for various reasons. Some were afraid that they could not deviate from the state curriculum.

There were two comments about preparation time being a factor in participation.

A teacher explained:

Of the two teachers in the mathematics program at our school, one was very active with the program and the other was not active at all. The teacher that was active was a hands-on type of person who was only involved in the classroom activities at school. Extra-curricular activities were not part of her assignment as

a teacher. The inactive teacher was coach of three sports and had no time for involvement because his plate was full.

A principal made the observation:

...the factor of preparation for integrating community resources and time involved may have had a greater influence than beliefs of philosophy did. Initially, at least, place based education is time consuming as resources, materials, and lesson plans that integrate the community resources is time and energy consuming. Coaching duties and extracurricular involvement took its toll in participation, as did lack of support from central administration and State Board of Education emphasis on test scores.

Others did not see a problem with the curriculum alignment. Their view was similar to the Vermont place-based education advocates who saw that the alignment helped legitimize the use of place-based pedagogy. According to one teacher:

The two are absolutely compatible. Curriculum based on place makes learning relevant for students. For example, instead of just asking a student to find the area of an enclosure, create the scenario that it is a lot for a hunting dog.

An administrator did recognize the conflict that the teachers were going through. He admitted that there was a certain amount of concern by the teachers at his school. He elaborated his viewpoint in the following comments:

The teachers had freedom to deviate from the state standards, and many did. Some, however, were too insecure, or did not wish to make the necessary preparation to articulate place-based methods and state mandated standards. Many teachers did integrate or articulate resources to meet the standards quite successfully. Test results were not noticeably different, but in my opinion the place based instruction was more meaningful to the students and more enjoyable for staff and students alike.

Residual Effects

Only two people interviewed were still at the respective cluster school: one was still teaching mathematics and the other was the principal of his school. The majority of comments about residual effects are seen through the lens of people who are no longer in

the community. Remarks about the residual effects came in three prongs: those who didn't see any residual effects, those who named specific items, and those who commented on personal effects.

One mathematics teacher who chose not to participate in the program commented: "I do not think there were any long term effects."

Two specific items were named as evidence of residual effects. A teacher stated: "During this time, we were able to build an Outdoor Environmental Education Facility which is still in use." And another teacher declared:

We applied for other grants to continue connecting the community to the school. One was to build a smokehouse. The State Department of Georgia wants us to do more things like that because this new program, Academic Service Learning, is right along the same lines. That's what they were wanting us to do is use place-based and use the community and serve the community.

Two people started describing how the program had an effect on them personally then added more comments. One administrator commented:

The ARC did make a difference with me, as it challenged me to encourage teachers to incorporate the classroom with the community, as was my philosophy, anyway. It reinforced my opinion that the testing program had too much effect on teaching methods, as I saw good teachers fearful of using their own good instincts for teachable moments to deviate from a strict standard curriculum and pursue paths that would truly make learning relevant. Those teachers who were confident enough and willing to risk venturing from the state adopted material, were rewarded with the experience, and individually, many continued to use those methods of place based education that were put into practice with ARC. I believe the newly established Early College Program, housed at Tri County Community College, is a direct outgrowth of the ideas developed with ARC and the TennGaLina Consortium. Its principal and two or its instructors are products of the ARC experience.

A retired key lead teacher voiced her opinion why the program wasn't sustained:

Well, I think my sense is that very little of it has lasted. That's my sense, I may be wrong about this. I think that for the people who were really actively involved in it, the people who are still in the teaching profession, that it still is very vital to

them. I think it changed their philosophy permanently. I think it's changed their experience as teachers permanently. I think that early on we saw a problem with bringing new teachers. Once we trained the teachers we had, then we had to bring in new teachers all the time and then had to train them in this so called new approach to education. I think that what the Rural Challenge provided for the schools was number one, the freedom to create a curriculum that the faculty felt that the community needed and would be an asset to the community. And also, the Rural Challenge provided the money to do these things that we wouldn't have the funds otherwise to do. I know that the Rural Challenge, taken as a group of all the schools that were involved, it did not survive because the organization of those schools collapsed as it were. But it's because there have been changes of the principals and then the funding wasn't there. And then in our case, we had schools that were scattered pretty wildly. Copper Basin, Ducktown and Hiwassee Dam were in 16 miles of each other. Those three compiled should have been able to sustain a real integrated relationship, but Woody Gap and Suches and Van Buren they are so far away, especially Van Buren, that we had communication problems. Even during the time that we were working together. But we were not able to create a viable organization that could continue pass the funding of the Rural Challenge it seems.

Finally, most key leaders did agree that there was an immediate impact on the schools and communities but the cluster lacked sustainability. The comments are summarized by an administrator:

Schools became revitalized, teachers and students and community members became excited about learning. Community members felt tied with the education of their children for the first time in years. But not much is left today of the program. When the money ran out, the process began to die slowly. Small pockets of teachers who believed in the work still exist. Ironically, the State Board of Education has recently installed some concepts into the curriculum requiring schools to implement student projects which are place-based in nature.

The themes investigated whether or not the mathematics curriculum, instruction, and achievement were impacted by the Annenberg Rural Challenge in the select schools from within the TennGaLina cluster are: mathematics teachers' interaction with the program, mathematics teachers' beliefs about the nature of mathematics and participation in the program, and the impact infusing rural context had on mathematics instruction and outcomes.

Mathematics Teachers' Interaction

Some mathematics teachers participated in the Annenberg Rural Challenge and some did not. Mathematics teachers who choose to interact with the program either based on utility applications of arithmetic, measurement, algebra, geometry, and statistics or as part of the cross-curriculum Mars Hill College design. Geometry was the mathematics subject mentioned the most with place-based education. Administrators recognized the difficulties that the mathematics teachers might have interacting with place-based pedagogy.

Mathematics teachers were not coerced into the Annenberg Rural Challenge. They could decline taking a part of the place-based program. Repeating a quote from a teacher:

Of the two teachers in the mathematics program at our school, one was very active with the program and the other was not active at all. The teacher that was active was a hands-on type of person who was only involved in the classroom activities at school. Extra-curricular activities were not part of her assignment as a teacher. The inactive teacher was coach of three sports and had no time for involvement because his plate was full.

Other teachers saw the program as a chance acquire resources to do more of what they were already doing. A teacher commented to the interviewer:

My principal had asked me to go to South Dakota with a couple of students to the national convention -- I don't remember what it was called, extravaganza or something. And it was about placed-based education and having the kids learn. And the kids at different schools, the schools were very similar to Woody Gap, very small, were doing these neat projects and learning their curriculum through these projects of placed-based education. We were doing that here anyway at Woody Gap, but we weren't sure exactly

what we were doing. ...what we were doing was taking some of the heritage of the area and the community members to come in and teach the kids. We just didn't have it to the extent that the other schools did.

Some mathematics teachers choose to interact with the program based on utility applications. They usually found mathematics skills embedded in a vocation then used that as the basis of the study. A mathematics teacher provided the detail of one such activity:

One of the projects that has come out of all this is for us to build a heritage farm which would be a replica of the settlement time, late 1800's farm. And part of the project was for the kids to figure the roof -- my trigonometry kids figured the pitch of the roof and how we're going to have to do the rafters. And we incorporated the math into that.

A key leader discussed her view:

I remember that and then when I saw the movie Apollo 13, I think that should be shown in every math class or every class. That one scene there where they're not sure that they are going to get the astronauts back, they have the toaster, they have a sock and, you know, they have to have -- these are your most highest, gifted mathematicians in the world just about it who are up in the spaceship and they have got just socks and plastic tubing and things and they've got to solve that whole problem to get them back, you know. To me, that's as practical knowledge of math as it could possibly be. And it means survival, ultimate survival. And when I think about the early pioneers that came here and the basic math is important about seasons and planting and harvesting and how much salt did you need to cure something and how to make things that you needed. I mean, math is basic to all of that and that's all placed based. I mean, to me, that's right here.

Other mathematics teachers followed the cross-curriculum Mars Hill College design and worked with other teachers on a local topic or theme. A teacher commented on how her school followed the model:

We sat down and looked the curriculum as a team. And the faculty, it changed throughout the year, but as a team we sat down and said, 'Hey, the kindergarten class could teach their math by counting how many hands high are the logs in the heritage cabin and between' that sort of thing. So we sat down as a team to pick

and pull things out of the state mandated curriculum that we could use our projects for to teach math.

An art teacher remembered working on activities and cross-curriculum units with a mathematics teacher:

Well, the thing I remember most was she had a math fair, like teachers would have a science fair. I'm not sure how place-based it was, but the students had studied famous mathematicians and then they had to choose a career that would stem from math and a major avenue for that career. And students would put together a display in the library and, more or less, explain that career to people. And I'm not sure if that was two different things because she had one that was on famous mathematicians and one that was on careers; it may have been that way. But I thought that was kind of neat. I learned a lot that I did not know just by seeing their exhibits. There was something she did with the stain glass type thing and I guess that was through the geometry. She did paper sculptures of the different volume type shapes. We did those wonderful toothpick sculptures using the triangles and putting them together. And one time we did a project on Buckminster Fuller, is that his name? He was famous for buckyballs, which is a carbon molecule that looks like a soccer ball and how that's related. Recently, we did patch-work soccer balls in geometry class. It's like this, if the math teacher wanted to incorporate art to teach the geometry through quilt making, they might not feel like they've got time to study all these different patterns that was in grandma's quilts; that's how the art teacher feels about having to study all the different math terms and things. So if you're going to have two people branching together with their craft or their knowledge, it's easier if you got equal commitment from both sides. However, as a teaching artist, I can tell you that coming into the classroom with the arts to bring to it, usually the artist -- and this is just my experience with this -- the artist is having to do the background for both.

Geometry was the most talked about area of the mathematics curriculum where place-based pedagogy was used. Many teachers were involved in “arts across the curriculum” training. They mentioned how geometric shapes influenced artistic compositions. In cross-case analysis, quilting was found in each of the schools sites as an example of a successful place-based curriculum alignment unit. Typically, the alignment protocol was based on a community artifact used to promote a collaborative effort between as many school disciplines as possible to create a unit of study. It is noted that

the component usually didn't start as a mathematics construct but a cultural or historical artifact. Quilting has a cultural identification and historical significance to small, rural, Appalachian communities. The art and craft of the design is particularly related to the mathematics curriculum to point out the embedded skills of geometry that include ideas such as pattern recognition and tessellations. Other nontraditional skills could be included in these studies. For instance in Hiwassee Dam's A+ Program artifact, "In Search of Enriched Assessment, Hiwassee Dam's Weaving Unit: Integrating Math, Computers, and Visual Arts," computer programming was integrated into the replication of traditional quilting patterns and the design of new quilting patterns.

Other schools included inviting elders of the community into the classroom to help in the piecing and sewing of the quilt commented:

We had activities in geometry. We do a geometry quilt and that was part of a -- actually, I was doing this before the Annenberg. It was something that the kids have to design and do their own quilt pattern. And they got the people in the community to help them -- their grandparents or whatever -- but they have to come up with all the math in order to get there.

Administrators were aware of the difficulties mathematics teachers would have interacting with place-based education. A key leader commented:

Math was the difficult one. It was an easy fit for social sciences, history, and English, but not so easy for math. We had no real model to follow. It was pretty much learn as you go. My math teachers did all they could do, but it was not an easy match. One math teacher totally bought into the program and the other interacted much less. Both were about equal in experience and number of years teaching.

On another note, an administrator observed interaction might be related to grade level:

The elementary school mathematics teachers pretty much adapted their methods to place-based ideas and the community-based models of the ARC. The high school math teachers were split with half going for traditional methods and the other half adopting the ARC model.

Mathematics Teachers' Beliefs about the Nature of Mathematics.

Four mathematics teachers were interviewed and asked various questions about their beliefs about the nature of mathematics. Also, one principal made a noteworthy comment about teachers' beliefs. Three of the four mathematics teachers said they were active in the Annenberg Rural Challenge program. The questions were based on the Yackel *Mathematical Beliefs Survey System* (Yackel, 1984). Questions in the survey are written in an effort to determine if the teacher tends to favor beliefs based on instrumental understanding or if they tend to favor beliefs based on relational understanding of mathematics (Skemp, 1976). The Beliefs Survey was designed on a five-point value scale and used to examine the beliefs about mathematics held by prospective elementary teachers. The survey instrument was developed by Yackel (1984) to determine the expressed beliefs of college students at Purdue University about mathematics, and to measure how likely they are to favor rule following (instrumental understanding) versus reasoning (relational understanding). Yackel (1984) based the design of her instrument, Beliefs Survey, on the long-time research of Skemp (1976). Skemp (1976) defines and compares mathematics beliefs expressed by “relational” learners to those beliefs expressed by “instrumental” learners. For the relational learner, mathematics involves more than memorizing and knowledge is constructed based on what has been previously learned. Problems are solved through the use of alternatives and not just reproducing an

algorithm. Learners take responsibility for their own learning, not just getting the right answer. Instrumental learners believe mathematics is a system driven by rules and procedures that must be memorized, that rules and procedures can be plugged into problems and the “right answer” can be found (Carter & Yackel, 1989). Yackel (1984) notes some of the responses “seemed” inconsistent, students might indicate that they believed that mathematics should make sense, but also believed that it is about rules and procedures. She believes that students who respond in this way really want math to make sense, but the use of rules and procedures is what “mathematics is to them” in their experience. She used the survey instrument primarily as a way to develop a better understanding of students who were enrolled in her undergraduate mathematics classes. She used the survey with many different groups of students and found the results to be very similar between groups. These observations led her to conclude that the instrument did identify the beliefs stated by the prospective teachers. A Reliability Analysis was constructed for the data collected for this study to determine the strength of the Alpha. No inferences about the results would be reliable because of the small number of mathematics teachers involved in the program. The data were collected for use in other potential studies.

The first teacher did not actively participate in the Annenberg program.

Responses about his beliefs in the interview were instrumental. He commented:

I view the teacher as an instructor. Mathematics skills need to be mastered in order to be proficient in the subject. I follow the curriculum guide for the state to the letter. Accountability and scores are major factors in the way I teach.

The second teacher participated and her response would suggest a relational belief. She declared:

My students had to keep portfolios of their work. They would have projects related to the curriculum. They would combine their classroom notes and work in the portfolio along with the things they discovered in their projects that related to the math skills studied.

The next teacher participated and signified that she had relational beliefs with some leanings toward instrumental. She commented:

I see myself as a facilitator and the students as learners active in constructing meaning. I feel that students learn more easily if they understand the purpose and relevance of the steps and procedures of mathematics. I could do what Annenberg wanted but it is easier just to stick to the textbook than to connect to the community in some ways. But I enjoyed creating units that interested the kids but stuck to the curriculum.

The last teacher interviewed participated and indicated an instrumental belief:

Students can't learn higher math skills until they master the basics. Some of my frustrations in the classroom come having to review materials they should have gotten in another class. So sometimes the class turns into a drill and practice session.

A principal commented about time influencing participation more than beliefs. He implied this could be applied not only for the mathematics teachers but for anyone regardless of discipline. He stated:

I believe it did [teachers' belief influencing participation], although the factor of preparation for integrating community resources and time involved may have had a greater influence than beliefs of philosophy did. Initially, at least, place based education is time consuming as resources, materials, and lesson plans that integrate the community resources is time and energy consuming. Coaching duties and extracurricular involvement took its toll in participation, as did lack of support from central administration and State Board of Education emphasis on test scores.

Infusing Rural Context

Eight interviews were conducted using a semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000). Each TennGaLina school had a person involved in at least one interview. Two administrators and two non-mathematics teachers

were interviewed who were either involved in initial start of ARC program or involved in the implementation of ARC program. The other four were mathematics teachers who were teaching at one of the schools involved during the implementation of the ARC.

Comments about the impact upon mathematics instruction and outcomes as results of infusing rural context were a mixed bag. One administrator succinctly stated: “I don’t think it had any impact at all.” One of the non-mathematics teachers replied in the opposite direction:

So as far as the place-based to me, what was beautiful about it was the education these students were getting was real connected and meaningful. And when everything is standardized across the nation, there is nothing specific to culture to heritage to what the students are experiencing in their own personal lives and we just lose that identity.

A third administrator also had a positive review:

Overall, the impact was positive in the community. Specific discipline such as some mathematics classes and some science classes may not have had much effect, but the use of local experts like surveyors, engineers, accountants, and craftsmen did have a significant impact on making mathematics instruction relevant to our students and rewarding to staff as they garnered the support of the community in the teaching process.

Comments by the teachers were also varied. The first talked about non-mathematic outcomes before she commented on quilts:

Well, one thing I'd like to instill in the kids here is to be proud of their heritage, of their roots. I feel like if they know where they come from and of their roots that they have a foundation to stand on as they go out in the world. If you're just sort of here and there and everywhere and don't have anything to be proud of -- I feel like it gives them a good, I guess, self-esteem or something to face life. You know, with the quilt, that is a wonderful tool and the kids discover the concept and they are more apt to remember those if they come up with the rules on their own instead of me saying here's the rule for this, all the angles of a triangle add up to a 180. But if they discover that on their own, then they remember it. But lots of times, I don't have time to let them.

Another teacher sent mixed messages but was generally negative:

I believed it gave some impact to instruction but to say meaningful, I do not know. I think the geometry classes benefited somewhat by the program but the rest of the Math Department felt very little impact due to their lack of participation in the program.

Artifacts Data

The following is a brief review of some materials generated by the TennGaLina Consortium. The purpose of the review is to look for items that will help address the research questions concerning how mathematics was treated in this Annenberg Rural Challenge program. Some items are included that had an indirect influence on how mathematics but effected the overall program.

“Initial Budget Proposal” Booklet

The “Initial Budget Proposal” booklet begins with an initial summary of objectives for the consortium. Originally, the schools referred to the phrase “site based curriculum” instead of “place-based curriculum.” It was implied in later artifacts that cite based curriculum was interchangeable with place-based curriculum in meaning.

In the summary of beliefs, it is stated, “...what they learn through the place in which they live...will translate empirically into better test scores, create community pride, and develop a viable work force able to sustain themselves locally.” I found no artifacts that indicated that the schools or the principle investigators attempted to collect data to assess, empirically, the program’s effect on achievement as described as test scores.

“We are using curriculum to create a process where our schools will always be forums for discussions of environmental issues.” This statement reinforces the notion that place-base education is viewed as a grassroots program springing from the study of the

environment and then applied to other disciplines. This viewpoint could imply that place-based education is aimed towards the sciences more than mathematics.

“We believe that the benefits of this process will be derived from its sustainability.” Unfortunately, the consortium was not sustained and for whatever reasons, as one teacher related, “When the money ran out the process began to die slowly.” In examination of personal classroom portfolios during site visits, it was apparent that some teachers continued to use components of the place-based curriculum generated by the consortium.

Funding of the consortium was scheduled to begin in September, 1997 and end in August, 2000. Later documents relate that there was a full semester delay in payments to the schools from the Annenberg Rural Challenge. It is not noted how this effected the administration of the project.

Initial budget proposals for all schools contained a substantial dollar amount for designing curriculum alignment. Key individuals in this project stated the driving force behind the TennGaLina consortium design of curriculum alignment was accountability to high stakes end-of-course testing. Unlike Vermont where place-based pedagogy was the main guide to align local curriculum with state and national standards, the emphasis with TennGaLina was on vertical curriculum alignment and cross-curricular thematic instruction. Mars Hill College’s vision of the sequence of development among the disciplines included topical alignment, pedagogical approaches, and analysis of actual use. Depending on the context of curriculum alignment—local, state, national—the purpose and consequences of the work influenced the degree of rigor, level of collaboration, and the protocol (structured process) that supported that purpose. The

expectations of the curriculum alignment efforts reflected the concerns of accountability with the high stakes tests and consisted of the following:

- Improved use of instructional time because of identification what is tested on the high stakes exit exams and what must be taught in the classroom.
- Networking opportunities with teachers from other schools in the consortium who are participating in the process.
- Successful implementation due to the level of administrative participation and support.
- Maintaining the instructional freedom for teachers who want to use various pedagogical methods.

In further items of interest in the proposed budget:

- Van Buren asked for an additional provision in support of “Plateau life across the curriculum”
- Hiwassee Dam specifically listed that the curriculum alignment sessions would be “3 days vocational, 1 day math, 1 day social studies, 1 day science, 1 day arts.”

This is rare evidence that mathematics was considered in the initial agreement.

Subsequent interviews with the staff of Hiwassee Dam revealed that workshop sessions involving the mathematics curriculum did occur. The “Rural Challenge Mars Hill Conference on Place-Based Education” document provides possible evidence of the effects of the training on creating lesson plans.

- Woody Gap listed “Alignment of site based education to be aligned with the Georgia curriculum and the Iowa Test of Basic Skills.” This confirms that testing accountability was a driving force behind the alignment of curriculum effort.

- Ducktown Elementary wanted Mars Hill to conduct “site based curriculum training.”
- Copper Basin sought alignment of site based curriculum with the Tennessee curriculum and frameworks. This is similar to the actions taken by the place-based advocates of Vermont that resulted in the development of a two separate place-based state standards in Vermont’s *Framework of Standards* document. I found no evidence in the artifacts that this was accomplished.

“Complete project reports, including lesson plans, materials and supplies, and annotated bibliographies, will be filled with school media specialists for future new teachers who will need to be trained in the process of community driven, project based integrated curricula.” Many of the people interviewed testified to the existence of portfolios with the intended materials but few documents were found during site visits. In regards to adhering to the plan, one teacher commented, “There was [teacher] turnover but no training for new staff so the program was not sustained.”

The document concludes with the description of the means of assessment and evaluation. “There will be on-going extensive internal assessments and adjustments of the programs in each school...The evaluation of TennGaLina will be ongoing, formative, and summative, making necessary adjustments as the consortium progresses...Benson and Hawkins will make one site visit per year to each school. One report...will be given to each consortium member school by mid-July.” I found two documents generated to this end; “Year-End Evaluation Report, June 1998-August 1999” and “Year 3 Final Evaluation Report for the TennGaLina Consortium Rural School and Community Trust Project” (dated August 1, 2000). A third document was produced, “Rural Challenge Mars

Hill Conference on Place-Based Education”, highlighting Mars Hill College’s assistance in creating lesson plans that “integrated site based curriculum.”

“Year-End Evaluation Report June, 1998-August, 1999”

This report summarized information and observations gathered by the Strom Thurmond Institute’s evaluation team during several visits to TennGaLina Consortium schools during academic year 1998-99. The report states the evaluators’ perception of the Consortium at the end of the second academic year, in June 1999. They commented on the Consortium’s conferences and meetings, strategic plan, becoming expert, and the portfolios and teacher research.

After the first year of implementation key leaders were no longer at Van Buren and Copper Basin. Phil Kiper and Rebecca Mobbs, respectively, had resigned their staff positions. The evaluators take account of the possible effect by including, “At the time of our interviews, two of the TennGaLina schools had lost their principals and no new persons had been named to succeed them. This uncertainty of transition caused some anxiety among teachers in these schools.” In a later document, “Year 3 Final Evaluation Report for the TennGaLina Consortium Rural School and Community Trust Project”, it was noted that teacher and leadership turnover was a major concern of the evaluators regarding program sustainability.

The evaluators write, “After two years of observing the TennGaLina Consortium, we have begun to view its members as experts in place-based curriculum...members began to alter the way viewed themselves and each other as resources this year.” This is an indication that by year two place-based education training was having a noticeable effect on the members’ pedagogical methods. The participants were encouraged to

generate information and become presenters of materials to each other and to interested outsiders.

Special areas of interest to the TennGaLina group were listed in broad terms as heritage, environment, and sustainability. Five specific goals of the strategic plan were developed in consortium meetings: building a unique partnership between school and community, creating a process that allows “place” to serve as the common thread in the curriculum, encouraging teaching that is informed by place, encouraging students, teachers, and the community to embrace technology together, and bringing together the TennGaLina communities around a common purpose and approach.

This report indicated the existence of site generated portfolios of work in all the schools with Copper Basin High School and Ducktown Elementary combining their collections. The evaluators stated that the portfolios were heavy on artifacts but light on reflections. They stressed emphasizing the context of the content in the reflective piece to help someone outside the consortium understand the context of the activity documented in the portfolio. They also emphasized that the portfolios should have a dual role of summarizing activities to serve as a public relation and formulating new ideas to uncover new activities that otherwise would not be noticed.

They further mentioned “a next step” to include modest forms of teacher research to give a close look at learning and achievement that aren’t available in standardized testing results. “Teacher research can give a clearer picture of what is happening in the school and help to explain how students are learning in the broad scheme of school life.” This idea of “a next step” was the evaluator’s suggestion on how to sustain the work of the project beyond the financial support of the Annenberg Rural Challenge.

The evaluators continued the report by submitting evaluative responses to each schools portfolio work. Many activities involving the school curriculum were described in the report. I could see where mathematics activities had to be or should have been incorporated in the activities but the following summarizes the report where mathematics is mentioned.

Copper Basin High School's portfolio was described as highlighting efforts in Arts Across the Curriculum, Environmental Studies, Community Outreach, and Economic Education. Only the arts across the curriculum section mentioned mathematics.

"In math classes, students incorporated cartoon drawings into mnemonic devices for the metric system, and used computers to draw graphs and create tessellations. Other students in math analyzed the concept of linear equations as they relate to patterns in quilt designs; another class studied the structure of snowflakes, including drawings, as they relate to geometry. Students in math technology class studied circles, lines, and angles. They used angle and arc measures to design patterns that were transferred to clear plastic and painted to simulate stained glass."

Ducktown Elementary's review began with a mild chiding for not constructing a portfolio. The evaluation was limited by the fact that there was no attempt to organize a record of the school's activities as related to the Rural Challenge. They were afraid of "omitting many good activities that resonate with RC principles." The evaluators relied on "the big projects" and site interviews of teachers involved in the initiative. The projects listed were Heritage and Community Outreach, The Green-Gold Conservancy, and Native American Garden. Although the garden project was described as a cross-

disciplinary project, no specific mathematics activities were included. There was no mention of mathematics in the other projects.

Hiawasee Dam's portfolio included the topics Community Outreach and Involvement, Encouragement of Students and Student Success, Environmental Studies, Heritage Studies, and Economic Studies. The student's academic success on state testing scores was highlighted but not shown to be related to activities begun by the Rural Challenge. The A+ Program was summarized as HDUS continuing "to unify the faculty in their efforts to provide students with cross-disciplinary curriculum that appeals to a variety of student 'intelligences' or capabilities." Weaving and quilting are included but there is no mathematics activity described other than the Business Math class hosting a speaker from a local bank to talk about credit cards and maintaining a good credit history.

Van Buren High School's report had the topics Community Outreach, Heritage Studies, Place-based Learning, and Environmental Learning. In the Place-based section, a project called "Rocket Trials: Calculation and Height by Trigonometry" was highlighted but no mathematics activities were illustrated. Emphasis on designing quilting squares was incorporated in the science and art classes but mathematics was not mentioned.

Woody Gap School lists Study of Local Heritage, Environmental Learning, and Economic Study and Sustainability as their focus of studies. In a project related to heritage, the high school mathematics teacher class "used the software 'Geometry Sketch Pad,' combining math and computer skills to produce a quilt to represent the local heritage of the area. All students had grandparents or other family members help them put the squares and shapes together. The quilt was displayed during Old Fashioned Day."

Rural Challenge Mars Hill Conference on Place-Based Education (dated June 7-9, 1999)

The purpose of this document was explained in “Year-End Evaluation Report June, 1998-August, 1999” as “the highlight of the conference at Mars Hill was the opportunity that teachers had to design curriculum projects together.” Under the guidance of the Institute at Mars Hill, six curriculum specialists were recruited to present ways “to reach their TennGaLina goals through curriculum development.” Specific areas of interest addressed were heritage, environment, and sustainability. Mars Hill compiled and distributed the resulting curriculum works to the entire consortium.

The document has a title sheet but does not have content page. The content pages contain the “curriculum projects” which lists the grade level, subject area, who submitted, objective(s), activities, evaluation, and supplementary reading materials. The submission section reflects the attempt to produce a collaborative endeavor using someone from each school. Many of the activities are described sparingly, such as, measure pH or calculate rate of float. While the activities were meant to reflect original works of the local curriculum sections of the projects looked like adaptations of other works. Originality was not the main concern because a majority of the report was a copy of “Johnson Farm Curriculum.” Other pages were copies from various curriculum sources, all not original to the TennGaLina consortium. A few works near the end of the document appeared to have been locally constructed. I will only summarize the activities that the subject listed was mathematics and appeared to be original works.

At the elementary level, objectives for units were counting money up to a dollar and measuring temperature. Middle school mathematics units involved Forest Service

Lands to calculate rate of flow, graphing timber sales, measuring circumference of trees, and calculating board feet. All these activities were listed in one unit with no explanation on how to do these things. Some the high school units were original works of consortium member but were reproduced from previous projects, such as “HDUS Outdoor Environmental Education Program.” The mathematics content was sparse. A unit, “Place-based Curriculum,” includes using Pythagorean Theorem to figure height of tree and finding diameter of a tree by circumference divided by “pi.” A mathematics unit, “Quilts”, did contain most of the elements of what the curriculum specialists from Mars Hill intended the participants to produce. The goal was to use geometric concepts to design and construct a quilt. The objectives incorporate identifying and classifying two dimensional figures, performing transformations including translations, rotations, and reflections of geometric figures to aid in designing quilt patterns, using Geometer’s Sketchpad to design a quilt pattern, and using problem solving skills, properties of triangles, perimeter, and area to aid in designing and constructing the quilt top and determine amount of materials needed. A brief procedure section is included as well as an assessment section. Two other mathematics units are included, one uses the coordinate system and proportions to study local landmarks and the other unit relates data collection from headstones of local cemeteries to perform statistical analysis to predict future trends such as life expectancy. Both units have descriptions for procedures and assessment.

Year 3 Final Evaluation Report for the TennGaLina Consortium Rural School and Community Trust Project (dated August 1, 2000)

This report addresses the third year which was the final year of evaluation and funding by the Annenberg Rural Challenge. The report describes and summarizes the

program as the consortium “continues to develop their expertise in place-based learning.”

The document begins with the Program Evaluation team’s discussion of five “most salient aspects of the program” and ends with the summary of the last site visits conducted in the spring of 2000.

The first salient aspect is “The Role of the Principal” at the site school. Observations were made noting the different leadership styles that the various school principals exhibited. The evaluators make clear the role of the principal determines to a large extent how teachers and students worked together in the place-based activities.

“In schools where the principal was a laissez-faire attitude toward the program, a core of teachers (and students) works in projects that tend to be classroom-bound. In other words, when the principal does not actively promote and enable the program, the work remains solely in the hands of the core of the teachers and isn’t shared by a great number of faculty and students. When the principal is involved in the program, however, there is a greater opportunity for the other teachers in the school to get involved, to participate in developing place-based curriculum, and create school change.”

The evaluators were concerned that the materials created by the consortium were not being shared and laid the responsibility of distributing information solely on the principals.

A change in leadership prompted the next aspect, “Coordination of the Consortium.” The TennGaLina coordinator’s position was viewed as the linchpin in the progress of the consortium as a whole. The position had been shared by two part-time leaders. The evaluators warned:

“The consortium is at a critical point in its development: it is poised to become a national leader in place-based curriculum of Southern Appalachia, and we would recommend that the consortium should be led by a full-time coordinator, with grant writing as part of the job description...to attract funding and lead nationally in the work it does.”

Despite the warning, a candidate was hired whose coordinator’s responsibilities were added onto his full-time school administrative position. He was described “as capable, knows the consortium, and can keep things running smoothly.”

“Stakeholders Meeting” was the third item. The evaluators recommended that the consortium convene a stakeholders meeting to chart new directions and find other opportunities when the funding ends. A proposed question was “How do we reconcile the mandate for state standards with our desire to teach a curriculum that is grounded in the local community?”

The fourth salient aspect, “Evaluator’s Role”, dealt with the evaluators allowing the Consortium to perform a self-evaluation. The self-evaluation would be under the guidance of the coordinator and based on the expansion of the portfolios each school had begun. The current evaluators proposed a change in their status with TennGaLina to providing professional development opportunities and to facilitate ongoing mentoring, research, writing, and publishing.

The last aspect highlighted the consortium’s “TennGaLina Retreat” celebration of three years of work. The Retreat was modeled on the Annenberg Rural Trust Extravanzas that were held each year at various school consortia. Each school presented materials that represented what their schools were currently doing. Woody

Gap's geometry class's quilting project was the only mathematics celebrated at the Retreat.

Copper Basin High Schools was the first summary written about the last site visits conducted in the spring of 2000. The evaluators focused on interviewing key teachers and students involved in TennGaLina projects. The school was preparing to launch a cross-disciplinary curriculum environmental study similar to the arts across the curriculum model. The objectives from the mathematics curriculum were to be aligned with designing gardens and walking trails. Mini-grants were offered as incentives to participate in developing activities but the grant required teachers to define objectives and goals of the project, to provide a timeline, to state teaching strategies, and show connections to state curriculum. The report continues reporting on seeking community support and local values, heritage, and history but no mathematics activities are listed.

The Ducktown Elementary evaluation dwelled on a new initiative of exploratory arts that the evaluators called Ducktown's "biggest change." The program was based on allowing flexibility to the school day schedule by creating a period at the end of each day for open-ended, hands-on, place-based activities. The activities included quilt-making, Appalachian dance (buck dancing), old-time parlor games, and traditional bluegrass music string instruments, guitar, banjo, and fiddle. The quilting activity was single out for an additional comment concerning the overwhelming participation of girls in the program. No mention was made of mathematics in the activity. In another venue, the environmental studies' Green Gold Conservancy won the Governor's Trail development Award in the spring of 2000. An assortment of activities were held celebrating Earth Day.

Hiwassee Dam completed a school-based health center as a result of community and school involvement. The school continued sponsoring festivities by celebrating Veteran's Day with a ceremony honoring thirty local veterans. The evaluation continued without specific reference to any mathematics lessons. The Envirothon Team placing second in the state, the music program continuing their Conga Club band, and additional mountain strings class similar to the Ducktown initiative were some of the new offers at the school. The evaluators noticed "a heavy emphasis on improving test scores and student achievement this year." They interjected standardized testing may be at odds with TennGaLina goals. "How can we be sure that the local knowledge that students master counts in the standardized test?" The documents of the lessons in the A+ program indicate that HDUS teachers integrate local knowledge and state mandates.

Van Buren High School went through a period of transition due to the departure of their principal who was one of the initial planners of the Rural Challenge. He was replaced by a steering committee composed of teachers of various teaching levels and disciplines. The new principal did not actively participate in the planning. The school continued their environmental studies. They sponsored a county-wide "Ag Day" and made few changes in the beekeeping program. They wanted to move the program to the high school. They also installed a new state-of-the-art greenhouse. The Heritage studies were spearheaded by its first Spencer Mountain Bluegrass Music and Crafts Festival. The Trail of Tears Association study invited the art, agriculture, music, English, and social studies departments. No mention was made of the mathematics department. Dr. Jim Guilford from Moorhead State was invited to begin using regional literature in the curriculum in order to teach appreciation for local values. Quilting "continues to be a

popular hands-on learning activity among VBHS teachers and students.” It was mentioned that quilting included skills students ought to know: design, proportion and scale, and other math skills.

The program at Woody Gap School also underwent a change of principal. But unlike Van Buren, the new principal was actively involved in Rural Challenge planning. Many construction projects were transforming the look of the campus and many of the students and teachers were involved in the design and construction. Woody Gap worked with the U.S. Forestry Service on fish hatchery projects and the science class went to Jekyll Island again. Six students and a teacher attended the national Rural Challenge meeting in Nebraska. They commented that Woody Gap was doing many of the same things that student from other parts of the country were doing. Students accompanied the Suches Historical Society as the visited old home site and trails in the area. The location of the trails traveled was recorded with the use of a global positioning satellite device.

Survey Data

Teacher Beliefs Survey

Four mathematics teachers took the Belief Survey (table1) and their scores were compared to their interview responses. Their scores on the Beliefs Survey ranged from 1.5625, relational to (2.9375) somewhat relational. It is surprising that all of the survey scores were rated relational. Comparisons of the interviews and the surveys showed that two results were inconsistent.

Table 1.

Beliefs Construct Comparison

<u>Name</u>	<u>Beliefs Survey</u> (Scores)	<u>Interview Responses</u>
Participant 1	2.9375	Instrumental
Participant 2	1.5625	Relational
Participant 3	2	Relational
Participant 4	2.2	Instrumental

Data of Interview Responses on Beliefs

Participant 1's Beliefs Survey score indicated that his beliefs somewhat relational however responses about his beliefs in the interview were near instrumental. The following are some examples of his beliefs shared in the interview:

I view the teacher as an instructor. Mathematics skills need to be mastered in order to be proficient in the subject. I follow the curriculum guide for the state to the letter. Accountability and scores are major factors in the way I teach.

Participant 2's score pointed to a strong relational belief and corresponded to comments in the interview. She states:

My students had to keep portfolios of their work. They would have projects related to the curriculum. They would combine their classroom notes and work in the portfolio along with the things they discovered in their projects that related to the math skills studied.

Participant 3's score signified that she had relational beliefs with some leanings toward instrumental. She states:

I see myself as a facilitator and the students as learners active in constructing meaning. I feel that students learn more easily if they understand the purpose and relevance of the steps and procedures of mathematics. I could do what Annenberg wanted but it is easier just to stick to the textbook than to connect to the community in some ways. But I enjoyed creating units that interested the kids but stuck to the curriculum.

Participant 4's score was also relational although interview comments would indicate a different result:

“Students can't learn higher math skills until they master the basics. Some of my frustrations in the classroom come having to review materials they should have gotten in another class. So sometimes the class turns into a drill and practice session.”

Summary of Data

Overall, the data from the TennGaLina interviews, the artifacts, and surveys suggest that the cluster embraced the tenets of the Annenberg Rural Challenge and was “poised to make a national contribution to the field of place-based learning in Southern Appalachia.” The initial plans were based on continuing with what each school was currently doing. Implementation slowly evolved toward the Rural Challenge vision of reform with unique adaptations. The TennGaLina cluster was not sustained and the residual effects tended to be localized. The data suggests that the mathematics curriculum, instruction, and achievement were only mildly impacted by the Annenberg Rural Challenge.

The program evaluators did not hold the TennGaLina cluster to a standard for curriculum reform or for quality in place-based learning. Instead, they let what happened stand as a model for how collaboration, growth, and change occur in small rural schools in Southern Appalachia. They encouraged the cluster to continue documenting, analyzing, and sharing distinctive programs evolving from their work.

Although the initial plan to continue doing what the “genuinely good, genuinely rural” schools were doing was enough to carry the schools through the first year, it was not sufficient to take the program toward Annenberg Rural Challenge’s vision of reform. Key leadership turnover made the participants uneasy. Mars Hill College’s cross-curriculum design was a timely adaptation providing a new direction allowing more participation by students, teachers, and community. The Mars Hill presenters addressed the TennGaLina interests in heritage, environment, and sustainability which paralleled the Annenberg Rural Challenge’s place-based themes. Many new programs sprung forth generally focusing on arts, music, and heritage studies.

After the third year, funding from Annenberg stopped and the cluster slowly died out. The TennGaLina cluster was not sustained because of lack of funds but by ignoring the recommendations of the evaluators. The evaluators stressed developing the schools’ portfolios to use as reason to network and share emerging programs that uniquely fit the context of the TennGaLina cluster. The recommendation was made in the final evaluation report but was apparently incorporated into the sustainability plans.

Mathematics reform was not a place-based education theme promoted by Annenberg Rural Challenge. In this study there is no evidence a model of place-based mathematics exists. If your discipline wasn’t one of the focus areas you had to figure out

were to fit in. Many people interviewed stated that mathematics and place-based curriculum was a difficult match. They saw no conflict with aligning State standards with activities that were included in the Rural Challenge. Mathematics was connected to the Rural Challenge themes by the cross-curriculum design. A cultural topic was selected and the mathematics teachers were invited to find the mathematics embedded. Quilting was the most popular cultural artifact the mathematics teachers developed activities. Quilting is a choice model topic because it is found throughout small rural Southern Appalachia areas and is loaded with mathematical applications. Other mathematics activities were developed but were based on traditional vocational topics.

Finally, the data revealed very few mathematics place-based units created during the Annenberg Rural Challenge. The units may exist and be housed in the portfolios. But I did not locate and inspect any portfolio. Many people interviewed stated creating place-based mathematical units took more time than their traditional textbook-based lessons. Several teachers commented on the political climate in which accountability testing intensified the conflict between teaching traditional methods and any new reform methods. Under these circumstances it is understandable that the mathematics teacher commented on few residual effects that impacted the mathematics curriculum, instruction, and achievement.

Chapter V

Discussions, Reflections, and Recommendations

Discussion

This study examined a prominent educational reform program, the Annenberg Rural Challenge, which was developed to meet the needs of educational agencies in rural locales. Specifically, the study gathered and analyzed data from an Annenberg cluster of five small rural Southern Appalachian schools. The analysis offers insights about the dynamics of how mathematics was treated or ignored in the program, what approach was used to address pedagogy and curriculum, particularly as it applied to mathematics and the long term effects, if any. Information was gathered with respect to the teaching and learning of mathematics keeping in mind the intended purpose, the actual practice, and the status ten plus years later.

In December 1993, Ambassador Walter Annenberg announced that the Annenberg Foundation would establish the Annenberg Challenge, a \$ 500 million project focused on improving large urban public school districts in the United States. The year after the initial announcement, rural educators and advocates associated with the Foundation insisted on the Challenge going beyond the urban setting. They advanced the idea that a national reform of schools was more likely to succeed in the rural schools rather than the large urban centers (ARC, 1997). A planning committee submitted a proposal for a national project that would develop a grants program for rural America. Two main components of the reform included the formation of cluster schools and place-based pedagogy. The Annenberg Institute accepted the proposal in 1995 and pledged \$50 million to support the Annenberg Rural Challenge.

The Rural Challenge

Annenberg's "Challenge" was based on the idea that the nation had a democratic obligation to educate all of America's children well. According to Paul Nachtigal (2000) the first Executive Director the Rural Challenge, Mr. Annenberg initially intended the money to only go to the large urban cities whereas the rural project was an afterthought. Former Brown University President Vartan Gregorian, a pro bono advisor to Mr. Annenberg stated, "No national school reform movement is complete unless it includes America's rural schools. Approximately half of our country's public school districts are rural ones - as are a third of the nation's schools and a quarter of America's teachers and students. These thousands of rural public schools are astonishingly diverse. Some of the nation's finest schools, as well as some of its mediocre ones, operate well beyond the cities and suburbs." (News From Brown, 1995).

The Rural Challenge was designed to encourage and assist rural schools and communities to build on the strengths of their small scale and to take full advantage of their uniqueness to create rural paths to educational excellence for all their students.

The Rural Challenge eventually grew to include thirty-five separate projects in three types of network/clusters: large statewide networks, specific program networks and small clusters. The statewide networks were first year grantees and received over fifty percent of the total funding to provide technical assistance and training programs. The second year grantees were the specific program networks. These programs were designed around a specific skill or theme. For example, the Southern Initiative of the Algebra Project was chosen because they could provide training and leadership to improve achievement in algebra while training parents to become involved in school and

community matters. The third year grantees were called clusters and consisted of small rural schools with some uniting component, such as geographical proximity. These clusters were comprised of between three and twelve schools all agreeing to abide by the Rural Challenge's core beliefs concerning school reform, namely, the creation of school networks and engaging school and community in a place-based curriculum. However, the idea of "pedagogy of place" was very difficult to envision because there was very little practical experience noted by the participants (ARC, 1997). The Rural Challenge spent the first year of the project developing just how the study of place should be implemented.

Originally based on David Orr's work (1992), the Rural Challenge eventually described place-based education this way:

A grounded, rooted learner understands that his/her actions matter, that they affect the community beyond the school. It is out of this particular formulation that the student as a resource to the community' takes shape...a pedagogy of place, then, recontextualizes education locally. It makes education a preparation for citizenship, both locally and in wider contexts, while also providing the basis for continuing scholarship (ARC, 1999b).

Evolution of the small clusters

The small clusters were to follow the lead of a partnering network. A cluster was to rely on regular interactions of associated institutions, community agencies, and other members of the cluster for expanding and extending place-base work in the schools and the communities. The clusters were to develop a consortium of people in the schools and communities to plan, articulate, and sustain the vision for the cluster as a whole. The Rural Challenge funding required the clusters to focus on curriculum innovation that related to the local community setting and on ways to integrate place-based with state

frameworks and content standards. The schools were encouraged to alter traditional schooling practices by receiving mini-grant incentives to facilitate those changes.

At the end of each funding year most clusters submitted portfolios to the national board highlighting the individual school's work and showing how that work furthered the goals of the Rural Challenge. The Annenberg funding ended after the third year. The original leadership anticipated that the clusters would develop a national network to provide specific services to rural schools and communities (The Rural School and Community Trust, 2000).

After the Rural Challenge funding came to an end in 2000, a new organization was formed named the Rural School and Community Trust to carry on work of place-based curriculum and pedagogy. The Trust focuses mainly on advocacy, research, and outreach to rural schools and their communities. In spite of the new support organization, some of the clusters did not continue after the funding ended. Others clusters found new sources of funding and continued as part of the national network. Still there are other clusters choosing not to belong to the national association (The Rural School and Community Trust, 2000).

There is an abundance of references to the power that place-based pedagogies hold for rural students and rural communities (Gruenewald, 2003; Haas & Nachtigal, 1998; Harmon & Branham, 1999; Howley et al., 1996; Kannapel & DeYoung, 1999; Ley, Nelson, & Beltyukova, 1996; Long, Bush, & Theobald, 2003; Theobald & Nachtigal, 1999) and a project as the Annenberg Rural Challenge should have provided the impetus to infuse this concept into the schools willing to take on the challenge. The collection of

works from the TennGaLina cluster provided a set of data with which to determine the extent of this impact.

Data Sources

Data from multiple sources provided concurrent validity for emergent findings. Major data sources included interview transcripts, local focus groups, field notes from observations, program documents, artifact collections, and surveys.

Setting of Participating Schools and Communities

Three of the schools in the TennGaLina Consortium, Copper Basin High School and Ducktown Elementary School in Tennessee and Hiwassee Dam Union School in North Carolina, are located within eighteen miles of each other. Before the copper mines closed in 1989, the enrollment of Copper Basin High School was 500; now it is 250. Two-thirds of the students qualify for free or reduced lunches. Only 25% of the current graduating class applied to institutions of higher learning. Ducktown Elementary School was built in 1933 for a college that was never certified and was placed on the National Registry of Historic Buildings in 1993. Ducktown is one of two elementary schools in the Basin and is a feeder school for Copper Basin High School. Hiwassee Dam was established in 1937 to educate children of local residents and construction workers building TVA dams in the area. The school shares its campus with the Hiwassee Dam Community club and the volunteer fire department. It is part of the Cherokee County, North Carolina school system and is located about sixteen miles west of Murphy, the county seat. It is one of the last “union” (K-12) schools in the state and has an enrollment of 425 students. Because of their isolation, all of the schools in the TennGaLina Consortium have avoided consolidation with larger county schools except Van Buren

County High School. This school, located in the county seat of Spencer, is the only secondary school in Van Buren County. Spencer is located on the Cumberland Plateau roughly in the center of a triangle formed by Nashville, Knoxville, and Chattanooga. The school serves 460 students in grades six through twelve. Woody Gap in Suches, Georgia is the last public K-12 institution and the smallest public school in the state. The school has an enrollment of ninety-one students and a faculty of fifteen making the pupil-teacher ratio seven to one. This school escaped consolidation with other schools in Union County, because residents of the community have a forty minute drive down a narrow, twisting road to Blairsville, the county seat. This lack of accessibility has helped to maintain a rural way of life in the area.

Participants in Interviews

From the literature published by the Annenberg Institute and the TennGaLina rural cluster, key players were identified as school administrators or teachers who were involved in the recruitment and initial planning of the Annenberg Rural Challenge (ARC) and teachers who taught mathematics at the various schools during the implementation of the project. Most of these people were no longer with their original TennGaLina schools. Some had retired from the educational field and most of the schools in this study had only one or two faculty members in the mathematics department.

Eight interviews were conducted using a semi-structured, traditional, question-and-answer protocol (Hollway & Jefferson, 2000). Each TennGaLina school had at least one person involved in interviews. Two administrators and two non-mathematics teachers were interviewed who were either involved in initial start of ARC program or involved in

the implementation of ARC program. The other four were mathematics teachers who were teaching at one of the schools involved during the implementation of the ARC.

Cross-case analysis revealed one non-mathematics and two mathematics teachers remain at their original schools although one of the mathematics teachers is now principal of his school. Three participants now serve in other school systems: an administrator is County Director of Schools, a mathematics teacher is the principal of a community college early college program, and a mathematics teacher is in the classroom. An administrator and a non-mathematics teacher have retired.

Surveys

The mathematics teachers completed the *Mathematical Beliefs Survey System* (Yackel, 1984) (Appendix A) within the time allotted for the interview. Questions in the survey are written in an effort to determine if the teacher tends to favor beliefs based on instrumental understanding or if they tend to favor beliefs based on relational understanding of mathematics (Skemp, 1976).

All four administrators completed an introductory questionnaire, “Mathematics in the Annenberg Rural Challenge” (Appendix B). This survey was developed by members of the ACCLAIM research project, “Significant Mathematics in Place-based Programs” (ACCLAIM, 2008). The survey was modified and used with permission given by ACCLAIM project Primary Investigator, Craig Howley, via email in the winter, 2007. The survey contained questions soliciting information concerning participants’ role in the TennGaLina cluster, years teaching experience, and awareness of Annenberg Rural Challenge’s expectations for participation. The data collected was used for identifying emergent themes in cross-case study analysis

Artifacts

The documents used in this study were produced by a team of evaluators from Strom Thurman Institute who were contracted to produce documents summarizing the yearly activities of each TennGaLina cluster site. The evaluation team produced two documents: “Year-End Evaluation Report June, 1998-August, 1999” and “Year 3 Final Evaluation Report for the TennGaLina Consortium Rural School and Community Trust Project (dated August 1, 2000).” A third document, “Rural Challenge Mars Hill Conference on Place-Based Education (dated June 7-9, 1999)”, resulted from a TennGaLina workshop conducted by curriculum specialists from Mars Hill College. Mars Hill College was contracted in the “Initial Budget Proposal” to assist the cluster in site based curriculum alignment.

A set of three questions guided the study. In the first section, I discuss each research question and then reflect on my findings. Recommendations for future research will follow at the end of the chapter.

Question 1: How did mathematics teachers in the case study schools interact or decline to interact with the Challenge program?

This report is an effort to understand how mathematics teachers in five small rural Southern Appalachian schools responded to a call for instructional improvement utilizing place-based education. Howley & Gunn (2003) cite evidence that mathematics in rural schools has changed little despite several reform movements over the past few decades. This study provided additional support for this claim. Data were collected from four mathematics teachers to see how they interacted with place-based curriculum as envisioned by the TennGaLina cluster. Four types of interactions were identified: limited

interaction, curriculum alignment, cross-curriculum alignment, and leadership interaction.

A teacher stated his interaction was limited to mandatory in-service programs concerning the Rural Challenge. Involvement with extracurricular activities conflicted with his perception of the time needed to participate in Rural Challenge efforts. He also stated administrative focus on accountability testing influenced his choice to teach only the state standards.

Rural Challenge artifacts support the idea many teachers' interaction with the program concentrated on curriculum alignment of their discipline with place-based activities. Interviews and documented activities confirm the participation of mathematics teachers in this activity. For example, the pitch of a log cabin was related to trigonometric ratios by comparing the pitch ratio of rise over run to the trigonometric ratio of sine angle over cosine angle. Furthermore, evaluators (who) suggest this interaction was dominant when the principal was not actively involved in the Rural Challenge leadership at their school.

To integrate more than one discipline in an activity, curriculum specialists from Mars Hill College designed cross-curriculum alignment activities. Some mathematics teachers-particularly in the lower grades interacted with the program in this approach. Quilting was used in all five schools where mathematics teachers collaborated with other school subjects to create a cross-curriculum lesson. Again evaluators suggest this interaction was most likely when the principal was a Rural Challenge leader.

Lastly, one mathematics teacher's interaction with the Rural Challenge program involved a role of leadership. She was a member of the initial grant proposal team from

Woody Gap. In addition to mathematics, she helped organized her school's Rural Challenge activities related to the heritage and environment studies. She received release time to attend TennGaLina and national Rural Challenge meetings.

Question 2: Did the mathematics teachers' beliefs about the nature of mathematics influence their participation in the Challenge program?

Some teachers participated in the Annenberg Rural Challenge and some did not. It is well documented that teachers are generally resistant to change in curriculum (Gruenewald, 2006; Kliebard, 1995; Zaraza & Fisher, 1993). Ball (1981) mathematics teachers were the most resistant to pedagogical change, in part because of their beliefs about the nature of their subject matter. This study does not attempt to theorize if mathematics teachers have a belief or a set of beliefs associated with place-based educational theory.

Each teacher holds a particular belief system comprising a wide range of beliefs about learners, teachers, teaching, learning, schooling, resources, knowledge, and curriculum (Gudmundsdottir & Shulman, 1987; Lovat & Smith, 1995). These beliefs act as a filter through which teachers make their decisions rather than just relying on their pedagogical knowledge or curriculum guidelines (Clark & Peterson, 1986). Teachers' beliefs about what it means to know and to do mathematics impact how they carry out the process of teaching and assessing mathematics in their classroom (Mewborn, 2002; Rousseau, 2004). Teachers' beliefs about learning also influence their instructional practices (Rousseau, 2004). Handel (2003) states teacher beliefs appear to be forceful enough to either facilitate or slow down educational reform, whichever is the case. Handel continues:

This dissonance bears serious implications for the implementation of curricular innovations since teachers' beliefs may not match the belief system underpinning educational reform. Even if teachers' beliefs match curricular reform, very often the traditional nature of educational systems makes it difficult for teachers to enact their espoused beliefs.

Many educators (Bush, 2005; Gruenewald, 2003; Howley 2004) have argued place-based education has been undertheorized. They maintain that many advocates of place-based education have sprung from ecological traditions which overemphasize the rural content without sufficient consideration of theory-building. Conversations are needed on features that distinguish place-based education from other philosophies of education. Teachers with "reform" beliefs about the nature of mathematics tend to engage students in mathematics through problem solving and reasoning, as opposed to having students listen to and watch the teacher solve problems, reason, and communicate about mathematics (Thompson, 1992). It has not been established whether teachers who focus on meaning for understanding can implement place-based methods any easier than teaches who focus on computations.

Mathematics teachers' beliefs in this study were determined by using the long-time research of Skemp (1976). Skemp defines and compares mathematics beliefs expressed by "relational" learners to those beliefs expressed by "instrumental" learners. For the relational learner, mathematics involves more than memorizing and knowledge is constructed based on what has been previously learned. Problems are solved through the use of alternatives and not just reproducing an algorithm. Learners take responsibility for their own learning, not just getting the right answer. Instrumental learners believe

mathematics is a system driven by rules and procedures that must be memorized, that rules and procedures can be plugged into problems and the “right answer” can be found (Carter & Yackel, 1989).

All of the teachers were rated relational with scores on the Beliefs Survey (see Table 1). The scores ranged from 1.5625, relational, to (2.9375), somewhat relational. A relational score suggests teachers believed students learn by hands-on and discovery methods. On the other hand, the interviews provided a variety in responses. The first teacher did not actively participate in the Annenberg program. Interview responses about the nature of mathematics suggest his beliefs were instrumental. He commented:

I view the teacher as an instructor. Mathematics skills need to be mastered in order to be proficient in the subject. I follow the curriculum guide for the state to the letter. Accountability and scores are major factors in the way I teach.

The responses of a second teacher would suggest she had a relational belief. She declared:

My students had to keep portfolios of their work. They would have projects related to the curriculum. They would combine their classroom notes and work in the portfolio along with the things they discovered in their projects that related to the math skills studied.

The next teacher signified that she had relational beliefs with some leanings toward instrumental. She commented:

I see myself as a facilitator and the students as learners active in constructing meaning. I feel that students learn more easily if they understand the purpose and relevance of the steps and procedures of mathematics. I could do what Annenberg wanted but it is easier just to stick to the textbook than to connect to the community in some ways. But I enjoyed creating units that interested the kids but stuck to the curriculum.

The last teacher interviewed indicated an instrumental belief:

Students can't learn higher math skills until they master the basics. Some of my frustrations in the classroom come having to review materials they should have gotten in another class. So sometimes the class turns into a drill and practice session.

All the teachers stated they participated in introductory Rural Challenge in-service programs. Only one teacher didn't take part in later activities. Comparison of the data collections did not reveal any conclusive evidence. Because of the small number mathematics teachers in the study the data can not be used to make valid statements about beliefs. The data collected can be used for use in comparison studies with other Rural Challenge sites. I believe this study provides data that indicates that more research is needed on how teacher beliefs influence their participation in educational reforms. Beliefs Survey scores for the four participants were found to be relational but compared to their responses to the interview questions, some individual discrepancies were found. There is a possibility that the questions included in the survey may not have been interpreted as intended by these individuals. Because of the lack of availability of other studies, I would recommend a similar study of the beliefs of mathematics teachers who are part of other Annenberg clusters to compare with the results of this study.

Question 3: Does infusing rural context (i.e. rural Appalachia) have meaningful impact upon the mathematics instruction and outcomes in rural schools?

Data gathered from TennGaLina mathematics teachers implies infusing rural context had little meaningful impact upon the mathematics instruction and outcomes in rural schools. Most activities mentioned were based on how mathematics was applied to place. There were few comments about mathematics gaining importance and meaning to the students because of infusing place however some teachers commented their students

became engaged with mathematics after the quilting project. Further analysis revealed that TennGaLina teachers were given cross-curriculum alignment and standards alignment as approaches to implement place-based education in their schools. Howley (2004) states similar strategies such as project-based learning, experiential education, and service learning are employed by teachers who claim to be engaged in place-based education. He further comments that the precise connections of these strategies to infusing rural context (place) for meaningful impact are not well articulated. By employing only these strategies, TennGaLina mathematics teachers' limited their perceptions of what constituted place-based education thereby limiting its impact.

Despite evaluators stating in the final evaluation report that the TennGaLina cluster was poised to become a national leader in place-based curriculum of Southern Appalachia, data collected in this study indicate that the mathematics teachers did not have a deep understanding of how infusing rural context could have meaningful impact on the mathematics instruction and outcomes. Mathematics teachers did not reveal in what sense an activity constituted an aspect of place-based education. Examples collected in the data show place-based education was sometimes attributed to finding the mathematics in a local economic enterprise, such as carpentry, and incorporating mathematics content into the context. Another venue used was posing problems in familiar contexts to introduce mathematical content. In both instances precise association to place and purpose were not well articulated. Howley (2004) argues these strategies not well connected to theorizing place-based education.

An article by Long, Theobald, & Bush (2003), Robert Klein (2007), reveals a model of how mathematics teachers can develop deeper applications of place-based education leading to meaningful impact:

First, in Craig, Colorado, middle schoolteachers orchestrated unique math-science lessons on the banks of the Yampa River. Working with the Colorado Department of Wildlife, students conducted a watershed study that involved mathematics in many different ways, including statistics. Temperature, alkalinity, and invertebrate population tests required simple correlation analysis. Students learned how mathematics could improve the quality of the Yampa River, thus improving the quality of life and economics for the Craig community while learning important mathematics and science in authentic contexts.

The example of Craig is not typical. What is typical is the strange hypocrisy that mathematics educators on the one hand promote the omnipresence and omnipotential of mathematics in everyday life, yet on the other hand seem to find it nearly impossible to articulate meaningful contexts of application that are not oversimplified to a point of absurdity. In an ironic twist, the television show “NUMB3RS” simultaneously proclaims that “We all use math every day” yet repeatedly showcases how trained criminal investigators have to hire a research mathematician to solve their problems.

What is truly remarkable about the Craig, Colorado, students’ use of mathematics is not the ways in which they applied mathematics to place, but rather the ways in which place was applied to mathematics. Mathematics gained importance and meaning to the students because of place, not the other way around. Mathematical techniques were pedagogy, a means of learning, not an abstraction underlying the natural and social order of the Yampa River.

Klein states that developing place-based mathematics is hard work. Many teachers would struggle with straying from the march through the textbook. Current high-stakes testing makes it difficult to take time and energy to explore and observe the community when the pressure is on teaching to the test. For successful implementation, Klein says “place-based educators need to invest class time in pursuing the issue of what meaning (personally, collectively) underlies the mathematics content” (p. 126). These are some of the conflicts mathematics teachers must consider before trying to integrate place-based education into their classrooms.

Reflections

Comments on Data Collected

This study used qualitative data and analysis methods in an effort to describe the integration of mathematics into place-based curriculum and instruction. Qualitative data is inductive and theoretical assertions will result from the process. But this type of study did not test hypothetical assertions, partly because little is known about implementing this variety of mathematics instruction and partly because of the nature of qualitative study (which is not designed to make predictions).

Overall, the data from the TennGaLina interviews, the artifacts, and surveys suggests that the cluster embraced the tenets of the Annenberg Rural Challenge and was “poised to make a national contribution to the field of place-based learning in Southern Appalachia” as the program evaluators stated. The TennGaLina cluster was not sustained and the residual effects tended to be localized. The data suggests that the mathematics curriculum, instruction, and achievement were only mildly impacted by the Annenberg Rural Challenge, if at all.

The program evaluators did not hold the TennGaLina cluster to a standard for curriculum reform or for quality in place-based learning. Instead, they let what happened stand as a model for how collaboration, growth, and change occur in small rural schools in Southern Appalachia. They encouraged the cluster to continue documenting, analyzing, and sharing distinctive programs evolving from their work.

Although the initial plan to continue doing what the “genuinely good, genuinely rural” schools were doing was enough to carry the schools through the first year, it was not sufficient to take the program toward Annenberg Rural Challenge’s vision of reform.

Key leadership turnover made the participants uneasy. Mars Hill College's cross-curriculum design was a timely adaptation providing a new direction allowing more participation by students, teachers, and community. The Mars Hill presenters addressed the TennGaLina interests in heritage, environment, and sustainability which paralleled the Annenberg Rural Challenge's place-based themes. Many new programs sprung forth generally focusing on arts, music, and heritage studies.

After the third year, funding from Annenberg stopped and the cluster slowly died out. The TennGaLina cluster was not sustained because of lack of funds but by ignoring the recommendations of the evaluators. The evaluators stressed developing the schools' portfolios to use as reason to network and share emerging programs that uniquely fit the context of the TennGaLina cluster. The recommendation was made in the final evaluation report but was apparently not incorporated into the sustainability plans.

Mathematics reform was not a place-based education theme promoted by Annenberg Rural Challenge. In this study there is no evidence a model of place-based mathematics existed. If your discipline was not one of the focus areas you had to figure out where to fit in. Many people interviewed stated that mathematics and place-based curriculum was a difficult match. They saw no conflict with aligning State standards with activities that were included in the Rural Challenge. Mathematics was thematically connected to the Rural Challenge by the cross-curriculum design. A few mathematics activities were developed but they were based on traditional vocational topics rather than significant mathematics.

Finally, the data revealed very few mathematics place-based units created during the Annenberg Rural Challenge. The units may exist and be housed in the portfolios that

did not surface. Teachers interviewed stated creating place-based mathematical units took more time than their traditional textbook-based lessons. Teachers felt that the political climate of increased accountability intensified the conflict between teaching traditional methods and any new reform methods.

Other reflections

Just as Annenberg Rural Challenge struggled with the idea of “pedagogy of place” because there was very little practical experience noted by the participants (ARC, 1997), I, too, struggled with what to count as a truly place-based mathematics activities. Rural Challenge specialists presented no specific models for place-based mathematics.

TennGaLina promoted two activities as place-based: aligning mathematic content with a local economic enterprise and cross-curriculum alignment with a local economic enterprise or a local artifact. Traditional environmental place-based education implies these are, indeed, examples (Sobel, 2004). However, Howley (2004), Long, et al. (2003) suggest creating activities where place is applied to mathematics. Mathematics is then a tool for describing and learning about place. The later viewpoint would consider the TennGaLina activities as strategies and not activities for theory building. I believe more discussions on this subject should follow.

Another concern was the reluctance of mathematics teachers in the cluster to take an active role in establishing a network, as the Rural Challenge evaluators suggested. Howley (2004) states theory-building requires judgment and argument about why educators should honor place, about the related commitments, and about the features that distinguish such an education from distant sorts (education that disregards place) and near-cousins (outdoor education). Networking could have assisted teachers in sharing

information and discussing specific mathematics issues related to implementing a place-based mathematics curriculum with a meaningful impact.

The program was funded for too short of a time period. At the end of the three years of funding most school sites were just starting to figure out what to do. It is very difficult to design studies around place because it is a learning process where the teachers learn to be responsive to the cultural setting of the school. Also, the cluster was unknowingly involved in theory building. At the inception of the grant, leaders of the Rural Challenge admitted that they were still trying to understand what place-based education means and how to implement it. In the case of the TennGaLina cluster, sustainability of the program was complicated by issues of teacher and leadership turnover, distance between the schools, differing State initiatives, communication (Internet accessibility), and lack of administrative support. The financial incentives helped bring the schools and should have been sustained long enough for the schools to overcome these issues.

Why try place-based?

Our students deserve and need the best mathematics education possible, one that enables them to fulfill personal ambitions and career goals in an ever-changing world (NCTM, 2000, p.4)

Why not stick to the traditional textbook-driven lessons? U.S. students, from kindergarten through 12th grade, have never ranked high in the world in math and science. There is no authoritative study that has ever ranked U.S. grade-school and high-school students in the highest achievement ranks in math and science. Accordingly, Bush (2005) comments:

Despite several national reform movements in mathematics education, students rarely have access to mathematics that matters. That is, the mathematics that many students learn is connected to neither them nor their community. Mathematics teaching often fails to challenge students or to provide them with the necessary knowledge for important life skills. The warrant for such claims is strong. Stigler and Hiebert (1999) studied videos of eighth-grade mathematics lessons from the United States, Germany, and Japan as part of the Trends in Mathematics and Science Study (TIMSS). Their analysis revealed that, when compared to German and Japanese mathematics lessons, U. S. lessons addressed mathematics at a much lower level, focused more on learning terms and practicing procedures, developed understanding of mathematics concepts less often, were more fragmented and less cohesive, made fewer connections within lessons, were rated considerably less rigorous in challenging students, and engaged student thinking less often.

If we want to reach more students than we currently reach, we should consider other alternatives. The above quote reminds us to seek out ways to improve learning, assessment, and instruction of mathematics. Using place and seeing mathematics as a meaningful tool for describing and addressing issues in a community could be a way for engaging more students in meaningful applications of their community to their mathematics studies. The biggest problem for implementing the place-based process is the time it takes to create curriculum. Finding ways in which place is applied to mathematics is not easy. It takes a high level of pedagogical and content knowledge to plan the mathematics study.

Where's the mathematics?

This question is asked in discussions about place-based mathematics. It will be a legitimate question as long as place-based education continues to be undertheorized. My view is the mathematics is there waiting to be applied to a phenomenon in a place. A team effort may be needed because a teacher may not have the time, the breadth or depth of knowledge about the community or mathematics.

The proper view is see the place applied to mathematics not mathematics applied to place. You can incorporate the mathematics while looking for answers to questions like, “Why are fish dying in the local river?” Maybe a solution is found scanning the community for possible causes and using mathematics to explore the relation to the stream. In rural areas, budget directors could make statements like, “I know more about planning cost-efficient rural bus routes because of my understanding of rural routes applied to the mathematics in the study.” The mathematics is there but the challenge is to recognize what and use place to study it.

Recommendations

1. Future research stemming from this study could include studying other Annenberg Rural Challenge clusters to see how mathematics was treated in those programs. The studies would add to the data base concerning this effort in educational reform. The large data base would allow for cross-case analysis where more inferences could be made.
2. A follow-up study to find and examine the portfolios developed by the schools sites would help support some of the tentative conclusions made in this study. This would produce actual teacher-generated lessons to analyze how place was applied to mathematics for meaningful impact with the students and community.
3. Support should given at the pre-service and graduate level for projects like ACCLAIM that encourage collaborations between rural educators, mathematics educators, and mathematicians to improve the quality of mathematics education programs. A collaborative group such as this could help theorize place-based education.

References

- A Nation at Risk: The Imperative for Educational Reform* (1983). The National Commission on Excellence in Education, U.S. Government Printing Office, Washington, D.C.
- AEL, Inc. (2000), March 13-17). Are today's schools teaching rural children how to live well in their own communities? Transcript from a listserv conversation with Dr. Toni Haas, Paul Nachtigal and others from across the nation. Retrieved March, 2005 from <http://www.ael.org/eric/pvtrans.htm>
- Ascher, M. *Ethnomathematics: A Multicultural View of Mathematical Ideas*. Pacific Grove: Brooks/Cole Publishing, 1990.
- Ball, S. (1981). *Beachside comprehensive: A case study of secondary schooling*. New York: Cambridge University Press.
- Barton, B. (1996). Making sense of ethnomathematics: Ethnomathematics is making sense. *Educational Studies in Mathematics*, 31, 201-233.
- Bigelow, Bill. (1996/97). How My Schooling Taught Me Contempt for the Earth. *Rethinking Schools Online*, Vol. 11, No. 1.
- Block, J. H. & Hazelip, K. (1995). Teachers' beliefs and belief systems. In L. W. Anderson (ed.), *International Encyclopedia of Teaching and Teacher Education* (2nd ed., pp.25-28). New York: Pergamon Press.
- Borasi, R. & Siegel, M. (1992). Toward a new integration of reading in mathematics instruction. *Focus on Learning Problems in Mathematics*, 14 (2), 18-36.
- Brown, C. A, & Borko, H. (1992). Becoming a Mathematics Teacher. In D. A. Grouws (Eds.), *Handbook of research on mathematics teaching and learning* (pp. 209-239). New York: Macmillan Publishing Company.
- Bullough, R. V. Jr. (1997) Becoming a teacher: Self and the social location of teacher education. In B. J. Biddle, T. L. Good & I. F. Goodson (Eds.), *International Handbook of Teachers and Teaching* (pp. 79-134). Amsterdam: Kluwer: Falmer Press.
- Burkhardt, H., Fraser, R. & Ridgway, J. (1990). The dynamics of curriculum change. In I. Wirszup & R. Streit (Eds.), *Development in school mathematics education around the world* (Vol. 2, pp. 3-29). Reston, VA: NCTM.
- Bybee, R. W. (1993). *Reforming Science Education*. New York: NY: Teachers College Press.

- Center for Education Reform and Empower America. (1998). Achievement in the United States: Progress Since A Nation at Risk? NCES. Retrieved September, 2004 from www.nces.ed.gov/Pressrelease/reform/
- Clark, C. M. (1998). Asking the right questions about teacher preparation: Contributions of research on teacher thinking. *Educational Researcher*, 17(2), 5-12.
- Clark, C. M. & Peterson, P. L. (1986). Teacher thought processes. In M. C. Wittrock (ed.), *Handbook of Research on Teaching* (3rd ed., pp. 255-296). New York: Macmillan.
- Closs, M.P. (1986). *Native American Mathematics*. Austin, Texas: University of Texas Press.
- Coleman, J. (1988). Social Capital in Creation of Human Capital. *American Journal of Sociology* 94 (supplement): S95-S120.
- Cooney, T. J., Shealy, B.E., Arvold, B. (1998). Conceptualizing belief structures of preservice secondary mathematics teachers. *Journal for Research in Mathematics Education*, 29, 306-333.
- Cornbleth, C. (1990). *Curriculum in Context*. London: Falmer Press.
- Crump, T. (1990). *The Anthropology of Numbers*. Cambridge: Cambridge University Press.
- Cuban, L. (1993). *How teachers taught: Constancy and change in American classrooms: 1890-1990*. 2nd edition. New York: Teachers College Press.
- Czerniak, C., & Lumpe, A. (1996). Relationship between teacher beliefs and science education reform. *Journal of Science Teacher Education*, 7(4), 247-266.
- Erickson, F. (1986). Qualitative methods in research on teaching. In M. C. Wittrock (Ed.), *Handbook of Research on Teaching*. (pp. 119-161). New York: MacMillan Publishing.
- D'Ambrosio, U. (1990). *Ethnomatematica*. Sao Paulo: Editora Atica.
- D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, 5(1), pp 44-48.
- Dewey, John. (1902). *The Child and the Curriculum*. Chicago, IL: Chicago Press.
- Dewey, John. (1915). *The School and Society* (Rev. ed.). Chicago, IL: The University Press.

- DeYoung, A. J., Howley, C., & Theobald, P. (1995). The cultural contradictions of middle schooling for rural community survival. *Journal of Research in Rural Education*, 11(1), 24-35.
- Dirkx, J. M., & Spurgin, M. E. (1992). Implicit theories of adult basic education teachers: How their beliefs about students shape classroom practice. *Adult Basic Education*, 2(1): 20-41.
- Eglash, R. (1997). "When Math Worlds Collide: Intention and Invention in Ethnomathematics." *Science, Technology and Human Values*, vol 22, no 1, pp. 79-97.
- Ernest, P. (1989). The impact of beliefs on the teaching of mathematics. In P. Ernest (Ed.), *Mathematics Teaching: The State of the Art* (pp. 249-253). New York: Falmer Press.
- Fang, Z. (1996). A review of research on teacher beliefs and practice. *Educational Research*, 38, 47-65.
- Fullan, M. & Stegelbauer, S. (1991). *The new meaning of educational change*. New York: Cassell.
- Gerdes, P. (1991). Lusona- Geometrical Recreations of Africa, African Mathematical Union and Higher Pedagogical Institute's faculty of Sciences, Maputo.
- Gibbs, Thomas J. and Howley, Aimee. (2000). "World Class Standards" and Local Pedagogies: Can We Do Both? ERIC Clearinghouse on Rural Education and Small Schools. Retrieved April 16, 2005 from <http://www.ael.org/eric/page.cfm?&scope=re&id=235&pf=x>
- Grant, Tim. (1998). A Breakthrough for Environmental Education. *Green Teacher*. # 56, Fall.
- Graham, P. (2002). Educational Reform---Why Now? *Proceedings of the American Philosophical Society*, 146 (3), 256-263
- Green, C. (2005). An interview with David Gruenewald. *Rural Mathematics Educator* [on line journal], 2(4). Retrieved March, 2006 from http://www.acclaim-math.org/docs/html_rme/rme10/04.02fea_green_selecting_the_clay.html
- Grossman, P. L. & Stodolsky, S. S. (1995). Content as context: The role of school subjects in secondary school teaching. *Educational Researcher*, 24(7), 5-11).
- Grossman, P., Wilson, S., and Shulman, L. (1989). Teachers of substance: Subject matter knowledge for teaching. In Maynard C. Reynolds (Ed.), *Knowledge Base for the Beginning Teacher*. Oxford: Pergamon Press.

- Guskey, T. R., (1986). Staff development and the process of teacher change. *Educational Researcher*, (15), 5-12.
- Gruenewald, D.A. (2003), Foundations of place: A multidisciplinary framework for place-conscious education. *American Educational Research Journal*, 40(3)
- Haas, T. & Nachtigal, P. (1998). Place value: An educator's guide to good literature on rural lifeways, environments and purposes of education. Charleston, VW: ERIC Clearinghouse on Rural Education and Small Schools.
- Haas, T. (1999). A reply to Kannapel, Coe, Aagaard, and Reeves. *Journal of Research in Rural Education*, 15, 16.
- Handal, B. & Herrington, A. (2003). Mathematics teachers belief and curriculum reform. *Mathematics Education Research Journal*, 15(1), 59-69.
- Hashweh, M. Z. (1996) Effects of science teachers' epistemological beliefs in teaching. *Journal of Research in Science Teaching*, 33, 47-64.
- Hord, S. M. (1988). The principal as teacher educator. *Journal of Teacher Education*, 39(3), 8-11.
- Howley, Craig. (1997). How to Make Rural Education Research Rural: An Essay at Practical Advice. *Journal of Research in Rural Education*, Fall, Vol. 13, No. 2, 6, 29-30.
- Huber, Donna, Howley, Aimee, & Howley, Craig. (2004). Prescriptions for Rural Mathematics Instruction: Analysis of the Rhetorical Literature. Paper presented at the annual meeting of AERA, San Diego, CA. Retrieved March, 2005 from http://acclaim.coe.ohiou.edu/rc/rc_sub/pub/3_wp/WP_22_Huber_Howley_Howley.pdf.
- Jackson, A. (1997a). The math wars: California battles it out over mathematics education (Part I). *Notices of the American Mathematical Society*, 44(6), 695-702.
- Jackson, A. (1997b). The math wars: California battles it out over mathematics education (Part II). *Notices of the American Mathematical Society*, 44(7), 817-823.
- Jennings, N. E. (2000). Standards and local curriculum: A zero-sum game? *Journal of Research in Rural Education*, 16, 193-201.
- Jennings, N., Swidler, S., & Koliba, C. (2005). Place-based education in the standards-based reform era—Conflict or complement? *American Journal of Education*, 122(1), 44-65.

- Kagan, D. M. (1992a). Professional growth among preservice and beginning teachers. *Review of Educational Research*, 62, 129-169.
- Kagan, D. M. (1992b). Implications of research on teacher belief. *Educational Psychologist*, 27, 65-90.
- Kang, N., & Wallace, C. S. (2004). Secondary science teachers' use of laboratory activities: Linking epistemological beliefs, goals, and practices. *Science Education* 89, 140-165.
- Kannapel, P. J., Coe, P., Aagaard, L., & Reeves, C. A. (1999). A rejoinder to Toni Haas'reply. *Journal of Research in Rural Education*, 15, 17-18.
- Kannapel, P. J., & DeYoung, A. J. (1999). The rural school problem in 1999: A review and critique of the literature. *Journal of Research in Rural Education*, 15, 67-79.
- Koehler, M. S. & Grouws, D. A. (1992). Mathematics teaching practices and their effects. In D. A. Grouws (Ed.), *Handbook of research in on mathematics teaching and learning* (pp. 115-126). New York: Macmillan.
- Lerman, S. (1990). Alternative perspectives of the nature of mathematics and their influence the teaching of mathematics. *British Educational Research Journal*, 16(1), 53-61.
- Lieberman, Gerald & Hoody, Linda. (1998). Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning. San Diego, CA: State Education and Environment Roundtable.
- McLaughlin, M. W. (1990). The Rand change agent study revisited: Macro perspectives and micro realities. *Educational Researcher*, 12, 11-16.
- NCTM. (1991). Professional standards for teaching mathematics. Reston, VA.
- Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19, 317-328.
- Njock, E. (1979). "Langes Africaines et Non Africaines dans L'Enseignement des Mathematiques en Afrique." Seminaire Interfricain sur l'enseignement des mathematiques. Accra, Ghana.
- Pajares, M. F. (1992). Teachers belief and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62, 307-332.

- Pierotti, Deb. (1999). Knitting a Community Together. Vermont Community Works, Curriculum Exemplar. Retrieved April, 2005 from www.vermontcommunityworks.org/exemplars/exempk-8/knitdp/knitdp.htm
- Richardson, V. (1996). The role of attitudes and beliefs in learning to teach. In J. Sikula (ed.), *Handbook of research on teacher education* (pp. 102-119). New York: Simon & Schuster.
- Rural Challenge Policy Statement. (1999). An Invitation to Discuss Standards in Public Schools. *Journal of Research in Rural Education*, Spring, Vol. 15, No. 1, 59-63.
- Rural Challenge. (1999a). Living and Learning in rural schools and communities: a report to the Annenberg Rural Challenge. Cambridge, MA: Harvard Graduate School of Education. p.12.
- Rural Challenge.(1999b). *Public school standards: Discussing the case for community control* (A report on the electronic symposium hosted by the Rural Challenge, November 1998 - February 1999). Retrieved January, 2005 from <http://www.ruraledu.org/esymposium/esymposium2.html>
- Rural Roots Newsletter. (2002). Vol. 3, No. 4, August.
- Sher, J. & Tompkins, R. (1977). Economic Efficiency and Equity: The Myths of Rural School Economy and District Consolidation. In J. Sher, ed., *Education in Rural America: A Reassessment of the Conventional Wisdom* (pp. 43-77) Boulder, Colorado: Westview Press.
- Sobel, David. (2004). On Place and Education. *Community Works Journal*, Vol. 6, No. 2.
- Sobel, David. (2004). *Place-Based Education: Connecting Classrooms & Communities*. The Orion Society.
- Smith, Gregory. Website: Retrieved March, 2005 from www.lclark.edu/faculty/gasmith/.
- Smith, Gregory. (2002). Place-based education: Learning to be where we are. *Phi Delta Kappan*, 83(i8), 584-94.
- Sosniak, L. A., Ethington, C. A. & Varelas, M. (1991). Teaching mathematics without a Coherent point of view: Findings from the IEA Second International Mathematics Study. *Journal of Curriculum Studies*, 23, 119-131.
- Starcher, Stephanie. *The Rural Mathematics Educator*. Vol.1, No.2 November 2002, Retrieved January, 2005 from http://acclaim.coe.ohiou.edu/rc/rc_sub/pub/1_nl/archives/rme2/01.02rea_thedoubtfu.html

- Stern, J. (1994). *The Condition of Education of rural Schools*. Washington, DC: Office of Educational Research and improvement, U.S. Department of Education.
- Schwartz, Robert. (1998). Lessons from TIMSS. *Hands On. Spr.*, Vol.21, No.1. Retrieved April, 2005 from www.terc.edu/handsonIssues/s98/schwartz.html.
- Theobald, P., & Curtiss, J. (2000). Communities as Curricula. *FORUM for Applied Research and Public Policy*, 15(1), 106-11.
- Thompson, A. G. (1984). The relationship of teachers' conceptions of mathematics and mathematics teaching to instructional practice. *Educational Studies in Mathematics*, 15, 105-127.
- Thompson, A. G. (1992). Teachers' Beliefs and Conceptions: A Synthesis of the Research. *Handbook of Research on Mathematics Teaching and Learning*. Edited by D. A. Grouws. New York, MacMillan: 127-146.
- Trumbull, D. J. (1990). Evolving conceptions of teaching: Reflections of one teacher. *Curriculum Enquiry*, 20, 161-182.
- Valencia, S. W., & Killian, J. P. (1988). Overcoming obstacles to teacher change: Direction from school-based efforts. *Journal of Staff Development*, 9(2), 2-8.
- Washburn, D.K. and Crowe, D.W. *Symmetries of Culture*. Seattle: University of Washington, 1988.
- Weva, Kabule. (2003). Adaptation of School Curriculum to Local Context. Association for the Development of Education in Africa, Biennial Meeting, Dec. Retrieved April, 2005 from www.adeanet.org/publications_biennale/docs/LesDocumentsdappui/Pertinence/K_AdaptatiWeva_eng.pdf
- Woodhouse, Janice & Knapp, Clifford. (2000). Place-Based Curriculum and Instruction: Outdoor and Environmental Educational Approaches. Retrieved January, 2005 from www.ael.org/eric/digests/edorcoo6.htm.
- U. S. Department of Education (2001), National Center for Education Statistics, NAEP 1999 Trends in Academic Progress: Three Decades of Student Performance. Retrieved March, 2005 from <http://nces.ed.gov/nationsreportcard/pdf/main1999/2000469.pdf>
- Umphrey, Michael (2004) Community-Centered Education: Does It Improve Test Scores? ArtistSearch, Montana Arts Council, May/June. Retrieved December, 2004 from www.edheritage.org/articles/artsearch/artsmat98.htm.

- Weinstein, C. S. (1990). Prospective elementary teachers' beliefs about teaching: Implications for teacher education. *Teaching and Teacher Education*, 6, 279-290.
- Yager, Robert (2003). Place-based Education: What Rural Schools Need to Stimulate Real Learning. *Rural Root Newsletters*, 4(1), p. 9. Retrieved September 14, 2003 from www.ruraledu.org/roots/rr401b.htm. Note: Now retrievable from www.elainaloveland.com/pdfs/Place-Based%20Learning%20-%20Rural%20Roots.pdf
- Zaslavsky, C. *Africa Counts*. Boston: Prindle, Weber & Schmidt inc. 1973.

Appendices

APPENDIX A

Mathematical Beliefs Survey

SURVEY # _____

Date _____

All individual responses on this survey will be kept strictly confidential. Your responses will be used to study the relationships between beliefs held by individuals about mathematics, mathematics content knowledge, and certain other variables such as previous mathematics experiences.

For each item, circle the response that indicates how you feel about the item as indicated below.

- | | Strongly Disagree
SD | Disagree
D | Undecided
U | Agree
A | Strongly Agree
SA |
|---|-------------------------|---------------|----------------|------------|----------------------|
| 1. Doing mathematics consists mainly of using rules. | | | | | SD D U A SA |
| 2. Learning mathematics mainly involves memorizing procedures and formulas. | | | | | SD D U A SA |
| 3. Mathematics involves relating many different ideas. | | | | | SD D U A SA |
| 4. Getting the right answer is the most important part of mathematics. | | | | | SD D U A SA |
| 5. In mathematics it is impossible to do a problem unless you've first been taught how to do one like it. | | | | | SD D U A SA |
| 6. One reason learning mathematics is so much work is that you need to learn a different method for each new class of problems. | | | | | SD D U A SA |
| 7. Getting good grades in mathematics is more of a motivation than is the satisfaction of learning the mathematics content. | | | | | SD D U A SA |
| 8. When I learn something new in mathematics I often continue exploring and developing it on my own. | | | | | SD D U A SA |
| 9. I usually try to understand the reasoning behind all of the rules I use in mathematics. | | | | | SD D U A SA |

- | | |
|--|-------------|
| 10. Being able to successfully use a rule or formula in mathematics is more important to me than understanding why and how it works. | SD D U A SA |
| 11. A common difficulty with taking quizzes and exams in mathematics is that if you forget relevant formulas and rules you are lost. | SD D U A SA |
| 12. It is difficult to talk about mathematical ideas because all you can really do is explain how to do specific problems. | SD D U A SA |
| 13. Solving mathematics problems frequently involves exploration. | SD D U A SA |
| 14. Most mathematics problems are best solved by deciding on the type of problem and then using a previously learned solution for that type problem. | SD D U A SA |
| 15. I forget most of the mathematics I learn in a course soon after the course is over. | SD D U A SA |
| 16. Mathematics consists of many unrelated topics. | SD D U A SA |
| 17. Mathematics is a rigid, uncreative subject. | SD D U A SA |
| 18. In mathematics there is always a rule to follow. | SD D U A SA |
| 19. I get frustrated if I don't understand what I am studying in mathematics. | SD D U A SA |
| 20. The most important part of mathematics is computation. | SD D U A SA |

Yackel, E. (1984). Mathematical Beliefs System Survey. Purdue University, West Lafayette, IN.

APPENDIX B

Questionnaire: Mathematics in the Annenberg Rural Challenge

General Instructions: This questionnaire is designed to gather and analyze data from the TennGaLina Annenberg Cluster to see how the teaching and learning of mathematics was treated in the program.

Your completion of the questionnaire is optional, and you may choose to omit any questions that you do not wish to answer. The researcher will treat all information gathered through the questionnaire as confidential and will publicly report only summary information about programs in general.

1. Please indicate whether or not you have read the general instructions provided above and agree to complete the questionnaire.
 - a. Yes, I agree.
 - b. No, I do not agree.
2. Did you play a major part in the initial Annenberg Rural Challenge grant proposal at your school?
 - a. Yes
 - b. No
3. Did you play a major part in the implementation of the Annenberg Rural Challenge programs at your school?
 - a. Yes
 - b. No
4. Have any of the programs begun by the Annenberg Rural Challenge grant continued to this present day?
 - a. Yes
 - b. No
5. Did your school have an overall theme that was emphasized during the Rural Challenge funding years?
 - a. Yes
 - b. No
6. Rural Challenge members were required to implement a place-based curriculum and to develop networks with other institutions. Were you aware of these requirements during the program?
 - a. Yes
 - b. No

According to the Rural Challenge, a place-based curriculum emphasizes connecting schools to community in a meaningful way. Teachers were to develop learning opportunities where students engaged in activities that addressed real issues in the local context, that were cross disciplinary, and that resulted in a product which would contribute in some way to the life of the community.

7. If mathematics was one of the subjects you taught during implementation of the grant, did you make connections with the community as part of the instruction you provide?
 - a. Yes
 - b. No
 - c. Not applicable
8. Did you change your teaching methods as a result of the Rural Challenge program?
 - a. Yes
 - b. No
9. Did you think that mathematics instruction was an important focus of the Rural Challenge program?
 - a. Yes
 - b. No
10. Did you develop specific place-based lessons that involved a component of the immediate school community?
 - a. Yes
 - b. No
11. Did these lessons involve students leaving the school?
 - a. Yes
 - b. No
 - c. Not applicable
12. Did anyone from the community come into the school and participate in the lessons?
 - a. Yes
 - b. No
 - c. Not applicable
13. Where mathematics content standards (national or state) reflected in the activities in which teachers involved place-based lessons?
 - a. Yes
 - b. No

14. In what ways did activities in which teachers made connections with the community go beyond the requirements of applicable content standards?
15. What math courses did you teach during the Rural Challenge program?
16. What is your current role at the school in which you participated during the Rural Challenge grant?
- c. I teach mathematics only.
 - d. I teach mathematics in addition to other subjects.
 - e. I teach something else.
 - f. I am a principal.
 - g. I am an administrator other than principal.
 - h. I am no longer associated with that school
17. How long have you been (or were) at that school?
- i. 1-3 years
 - j. 4-6 years
 - k. 7-10 years
 - l. More than 10 years

APPENDIX C

Summary

We, of the TennGa'Lina Consortium, are actively involved in creating a process which allows our students to learn what they learn through the place in which they live. We believe that this type of learning is not only more expedient, but it also will translate empirically into better test scores, create community pride, and develop a viable work force able to sustain themselves locally.

We have determined to make our schools and communities learning labs from which to draw a wealth of resources. We are using curriculum to create a process where our schools will always be forums for discussions of environmental issues. We hope to train our teachers to think and teach in a manner which will sustain sit-based education for generations to come. We believe that teachers are the key to the success of this process.

We believe that the benefits of this process will be derived from its sustainability. Our schools and communities are dedicated to this belief. In short, we believe that our children will learn better, not in spite of their ruralness, but because of it.

The five schools in the TennGa'Lina Consortium—Van Buren County High School in Spencer, Tennessee, Hiwassee Dam Union School in Hiwassee Dam, North Carolina, Ducktown Elementary School in Ducktown, Tennessee, Copper Basin High School in Copperhill, Tennessee, and Woody Gap School in Suches, Georgia—represent isolated Appalachian communities whose culture reflects a strong sense of place. It is the desire of the faculties, staffs, students, and members of the general public in these five communities to strengthen the partnerships between the schools and the communities, to preserve the integrity of the culture, to protect the natural environment, and to adjust to the changing economic needs of the residents of these communities.

The motto of the TennGa'Lina Consortium is "Weaving the past together with the present for the future." This metaphor describes the process which the schools and communities are using to accomplish their goals. The loom is the past history of each place; the threads on the loom (the warp and weft) are the natural and human resources available in each place; the weavers are the individuals who cooperate and collaborate within the schools and the communities; and the tapestries created by the weavers are visual representations of the present which will serve as guides to the future. The schools in these consortium have begun the transformation of their schools from traditional hierarchical institutions to student-centered learning models with teachers serving as facilitators. Also, the teachers in the schools have reached the point in this transformation when they see the need to accelerate the process by using community driven, project based, on-going curricular development—to become weavers not assembly line workers.

As weavers the members of the TennGa'Lina consortium are exploring ways to make the schools more open and accommodating to the public, as participants in the programs rather than as guests of the faculty and staff. By enhancing their accessibility, the schools encourage parents and community members to attend classes or special events to hear guest speakers, and to instruct some of the class projects. Also, there is a recognized

need for the schools to become after hours family learning centers to encourage and to facilitate life-long learning. Residents of the communities will think of their schools as educational institutions for the public, not just as public schools.

One of the greatest needs in all of these communities is economic opportunities for young people. Because of the scarcity of local jobs, too often graduates must leave their mountain homes to find work. Therefore, students in the schools of the TennGa'Lina Consortium will participate in a collaborative environment with business and professional leaders of the communities in programs such as service learning, cooperative learning, and job shadowing. Also, the schools recognize the need for students to plan and to prepare for changing economic conditions.

In spite of economic hardships, most of the students prefer to live their adult lives in their mountain communities because of their strong attachment to their homes and to their families. This love of place is reflected in community mandates to the schools of the TennGa'Lina Consortium to preserve the heritage and the communities of Appalachia. Since the states of Tennessee, Georgia, and North Carolina each has different curricular directives the schools must align the state mandates with local resources and opportunities.

Because of their isolation, all of the schools in the TennGa'Lina Consortium have avoided consolidation with larger county schools except Van Buren County High School. This school, located in the county seat of Spencer, is the only secondary school in Van Buren County, which has the third smallest county population in the state of Tennessee. Spencer is located on the Cumberland Plateau roughly in the center of a triangle formed by Nashville, Knoxville, and Chattanooga. The population of the county is relatively stable. In any given year withdrawals and new entries in the school will only run about two percent. Most of the residents come from families which have been in Van Buren County since pioneer days; the total population, white Protestant, has changed little since the 1850 census. The school serves 460 students in grades six through twelve. Seventy percent of these students qualify for free lunches. Nearly seventy percent of the county's land belongs to two absentee landlords, both large corporations. Almost all of the county is covered by forest. Fall Creek Falls State Park, the largest state park in Tennessee, is in Van Buren County and its neighboring county, Blount.

Van Buren High School's mission statement emphasizes interdisciplinary teaching and community-connected learning. An example is writing across the curriculum which incorporates local heritage education in all disciplines of the school. Another example is the horticulture program. Because the area nursery industry is one of the largest in the world, it provides opportunities for future employment for the school's graduates. Responding to this need, the school introduced a horticulture program and built a green house to incorporate learning in all academic areas while studying native plants and wildflowers. As a result of the community's interest in this program, one of the large land companies in the county is dedicating property so that students can grow and study native plants. Another benefit of the horticulture program is the development of a relationship between the school and Fall Creek Falls to discuss a possible partnership

with the park's expert staff and the school's horticulture program. The goal of this partnership is to involve students in a project to reintroduce native plants to the grounds of the Fall Creek Falls State Park nature center. Another aspect of the horticulture program is an on-going discussion in the classroom of environmental issues such as how clear-cutting timber affects the local environment and how strip mining impacts the Fall Creek Falls watershed. Students consider the issues of good stewardship of the land, of conflicting economic needs of various segments of the community, of the responsibility of good citizenship, and of the necessity to plan for sustainable environmental programs. Finally, the biggest project for the school and the community will be the creation of the Daisy Rhinehart Plateau Life Museum. The heirs of Ms. Rhinehart have agreed to give her home and its furnishings to the Van Buren High School Education Foundation to function as a center of activity where the school and the community may meet to share work, ideas, and experiences. Students will landscape the grounds to display the native plants and wild flowers; they will assist in the restoration and decoration of the house; and they will learn how to renovate historical sites and artifacts. These projects will utilize the knowledge, skills and talents of local artisans and horticulturalists.

Three of the schools in the TennGALina Consortium, Hiwassee Dam Union School in North Carolina, and Ducktown Elementary School and Copper Basin High School in Tennessee, are located within eighteen miles of each other. Hiwassee Dam was established in 1937 to educate children of local residents and construction workers building TVA dams in the area. The school shares its campus with the Hiwassee Dam Community Club and the volunteer fire department. It is part of the Cherokee County, North Carolina school system and is located about sixteen miles west of Murphy, the county seat. It is one of the last "union" (K-12) schools in the state and has an enrollment of 425 students. The school's population has leveled off after declining by a third since the shutdown of the mining operations in neighboring Polk County, Tennessee a decade ago. About sixty percent of the students at Hiwassee Dam qualify for free and reduced lunches, and about seventy percent of the graduates go to institutions of higher learning. Of these, most receive some form of financial aid. Also, new people are moving into the community and driving to work elsewhere, in large part so that their children can go to school in a "safe" rural environment. Now the parents of about half the children currently attending Hiwassee Dam did not grow up in the community.

The philosophy of Hiwassee Dam Union School states that students learn in many different ways (i.e. Gardner), that traditional methods are inadequate for the needs of many students, and that nonacademic skills and ways of learning and knowing are undervalued in the standard curriculum. To implement the school's philosophy, the faculty, students, and members of the community are developing a curriculum to include interdisciplinary teaching and community-connected learning. They are using local and regional colleges, universities, arts councils, state and federal forest services, TVA, and numerous other resources to develop and to sustain a nature trail, an outdoor classroom, a wetlands area, and a recycling station. They are also providing opportunities for the students to learn about and to participate in various arts, crafts, and cultural programs. The Kennan Institute granted a five-year "A+" status to the school for the integration of arts and academics. Now in its third year, the program has been well received by the

community. Encouraged by the success of these programs, the faculty has set new goals: to devise a curriculum that will ensure the continuation of the rural economy and culture, to explore ways to integrate the influx of tourism with the culture of the region, to utilize community resources and people in educating the students, to develop a program that will become self-sustaining, and to incorporate the goals, skills, and philosophy of the "A-" program into a cultural preservation process. The school also needs a focal point for its integrated curriculum and a place to exhibit students' work. Recognizing this need, the students, the faculty, and the community are discussing the possibility of constructing a building to house a permanent gallery and an outdoor theatre. It will be a place where the community can gather for public meetings; a place for local artisans and craftspersons to conduct workshops and exhibit their work; and a place where students can participate in plays, in musicals, and in dramas. The conception, construction, and program design of the center will be done by students and by the community with school faculty extracting courses and lessons from the work being done. The students will also use computer technology and the internet to advertise their arts and crafts and their co-sponsors. Together the community and school at Hiwassee Dam, North Carolina will create a sustainable, ongoing, relevant educational process that preserves the past, energizes the present, and inspires the future.

Ducktown Elementary School was built in 1933 for a college that was never certified and was placed on the National Registry of Historic Building in 1993. The town of Ducktown, in the Copper Basin, is in the eastern Polk County, the southeastern most county in Tennessee. The copper mines opened in 1850 and closed in 1989 with the loss of 2500 jobs and much of the population of the Basin. Currently, the population is 5000 and the unemployment rate is twelve percent. The enrollment of the school is 270 students in pre-school through seventh grade. Seventy percent of the students qualify for free and reduced lunches. Ducktown is one of two elementary schools in the Basin and is a feeder school for Copper Basin High School. The school's mission is to preserve the integrity of the community and its heritage by developing a place-based curriculum. In 1990, Ducktown faculty began the implementation of this mission with the establishment of the Green Gold Conservancy on the school's 160-acre campus. Its goal is to foster stewardship of the community's environmental resources. The conservancy consists of three trails, ten separate habitat areas, and numerous outdoor teaching spaces and interpretive trail markers, all created by students and community members. Students work with a community advisory board which sets goals and assesses the projects. However, the students direct and carry out the work on these projects. They have constructed and erected birdhouses, cleared trails, studied flora and fauna native to the campus, identified a salamander nursery, and learned the importance of stabilizing and preserving the endangered cranberry flood plain. (The conservancy is home to the southernmost naturally occurring cranberry bogs in the United States.) The conservancy has developed a working partnership with thirteen area conservation, government, and service agencies and organizations. As a result of the conservancy's accomplishments, the school has received state-wide recognition.

Encouraged by these accomplishments, the faculty wants to expand the curriculum to embrace local heritage using the process model established by the Green Gold

Conservancy. A community advisory board will assist students and faculty members in designing this program. In addition, local artisans, craftspeople, storytellers, and musicians will be an integral part of the instructional process. The goal is to incorporate Native American and Appalachian heritage in all grades and all subjects. Social studies classes will learn local history and heritage; music, dance, drama, and crafts will become part of the learning process; and the language arts classes will include regional literature and the art of storytelling.

Before the copper mines closed in 1989, the enrollment of Copper Basin High School was 500; now it is 250 in grades 8-12. Two-thirds of the students qualify for free or reduced lunches. Twenty-five percent of the current graduating class applied to institutions of higher learning; two joined the armed services. When the mines closed, the dynamics of the community changed because there is no major source of employment in the area. Five years ago, faculty, students, and members of the community recognized a need to reform the curriculum to meet the changing needs of the community. Numerous meetings, extensive self-studies, and prolonged discussions followed. The goals are to increase expectations of the students, to actively involve them in the learning process, and to prepare them for new jobs. To begin the implementation of these goals, general track courses were eliminated, block scheduling was introduced, an advisory program utilizing the homeroom time was begun, and cooperative learning and job shadowing became part of the technical program. Additionally, the school was selected to be a High School That Works site, and this program is presently in its sixth year. The school has also received grants from Appalachian Educational Laboratories, Orion Society, Clemson University's Writing for the Public, Tech Prep Consortium, Levi Strass, Polk County Historical Society, and 21st Century Classroom.

As part of the curricular reforms, the faculty and students of the school recognize the need for a place-based, environmentally sustainable educational program that can adapt to the changing economic demands. The same process will be used as was used to institute block scheduling. Also, a community advisory committee will be created to assist the school in developing short- and long-range objectives for community planning and economic development, and to create a model for on-going assessment. Also, the school will develop partnerships with local arts organizations, the mining museum, local businesses, and the Cherokee National Forest. Staff development workshops are being planned to incorporate local heritage and environmental studies into the curriculum, to accommodate the different learning styles (i.e. Gardner), to implement writing across the curriculum, and to develop art and ecological activities for all subjects. In the future, Copper Basin High School hopes to become a center for ecological study because the Basin offers examples of all degrees of environmental degradation and reclamation. Also, the school plans to coordinate its environmental studies with those of the Green Gold Conservancy at Ducktown. Finally, the school plans to align its local curricular mandate with those of the state.

Woody Gap in Suches, Georgia is the last public K-12 institution and the smallest public school in the state. The school has an enrollment of ninety-one students and a faculty of fifteen making the pupil-teacher ratio seven to one. This school escaped consolidated

with other schools in Union County, because residents of the community have a forty minute drive down a narrow, twisting road to Blairsville, the county seat. This lack of accessibility has helped to maintain rural way of life in the area. Many of the students come from families who have lived in these mountains for several generations. Much of the area is national forest or state wildlife management land. Most of the parents work for the forest service or in construction and manufacturing positions that require them to leave the community. But to the people of Suches, preservation of the community is the citizens' responsibility. They built a Neighborhood Health Center and a fire hall with the help of grants; they volunteer to serve the Suches Fire and Rescue program; and they organized a recreation association and applied for and received grants to build ball fields and tennis courts. These residents are convinced that the survival of the community of Suches depends on the continued existence of Woody Gap School and have made a strong commitment to support it. They stage an Indian Summer Festival each fall to raise money for the school's needs. This includes building an outdoor stage, a weight room, and a concession building; providing scholarships; and supporting both the sports and the academic programs. The parent-teacher-student organization raised more than \$20,000.00 to buy the schools' first computers, and then the school offered a course in computer use to the community residents. A local resident gave \$10,000.00 to purchase science equipment for grades K-12. Suches volunteer fire department provides the school with substitute teachers, and individuals within the community often volunteer their time to read to the elementary and Middle school students.

Like Hiwassee Dam, the community of Suches needs a community center/school media center. To accomplish this, the residents have become political activists. They have met with the local school board, the superintendent of schools, and their state representative. Woody Gap School is an essential partner in the success of this project. The community mandate to the school is that a vocational emphasis needs to be added to the curriculum. The goal is for students and teachers to discover new ways of teaching and learning in hands-on, rurally based, vocational activities by initiating the use of community and regional resources. Students will learn the elements of construction ranging from architecture and design to actually building the center. They will learn how to frame, plumb, lay blocks, and bricks, wire and roof. Local artisans and craftsmen will work as consultants with the teachers and students to develop a process of teaching and learning that is relevant to the community's needs. Volunteerism among community members will be encouraged, and donations of materials will be needed. To further encourage community participation, this community/media center will become a place where local artisans and craftsmen can share their knowledge and skills with the students and faculty, a place where their skills not only build but sustain a community, and a place where students can be productive citizens of their community. This vision shared by Woody Gap School and Suches community exemplifies the motto of the TennGa'Lina Consortium: "Weaving the past together with the present for the future."

This metaphor of weaving also describes the proposed relationship between the schools in the consortium. The schools plan to exchange information via a newsletter, a web site, and conference calls. Teachers from schools will serve as consultants to other member schools by conducting professional development meetings. Visitation of students and

teachers to consortium schools will be encouraged and facilitated. Annual meetings of consortium members including teachers, students, and community members are proposed. Schools will offer information and assistance to non member schools and will encourage visitation from those schools. Plans are being made to communicate with Rural Challenge schools in other parts of the country via telecommunications networks. On the local level, information will be published in the local newspapers, and, in the communities that do not have local newspapers, students will circulate newsletters. Complete project reports, including lesson plans, materials and supplies, and annotated bibliographies, will be filed with school media specialists for future new teachers who will need to be trained in the process of community driven, project based integrated curricula.

There will be on-going extensive internal assessments and adjustments of the programs in each school. Chris Benson and Melissa Hawkins working with Dixie Goswami of the Strom Thurmond Institute of Clemson University will conduct an annual internal evaluation of the TennGa'Lina Consortium. Their assessment questions will be focused on the goals set by the consortium. Questions to be assessed will include: How is the integrity of place being preserved in each community? What is being done to protect the natural environment in each community? How are schools working with community members to adjust to the changing economic needs of their communities? To what extent have schools opened up to their communities, making community members participants in school reform? How effective are the advisory boards in their communities? How has consortium sharing benefited each school? What steps have been taken to insure that the process of community driven, Project based, on-going curricular development is occurring in each school?

The evaluation of TennGa'Lina will be on-going, formative, and summative, making necessary adjustments as the consortium progresses. Benson and Hawkins will maintain on-going communication and consultation via phone or e-mail. They will also design a brief reporting format for each member school of the consortium to complete. These reports will be requested on October 1, December 1, and March 15 of each project year. The report contents are not limited to text and may include project artifacts such as art work or transcripts of students conversations.

After a report is submitted, Benson and Hawkins will respond within a month and make necessary adjustments to the report format. This report-response pattern will allow them to gather data and to formulate interview questions. Benson and Hawkins will make one site visit per year to each school. On these visits, three dyads will be interviewed. Dyads include representation from the students, faculty/staff, and community. One report, based on information compiled throughout the year including the reports, interviews, and site visits, will be given to each consortium member school by mid-July. From these reports, the schools in the consortium will be able to begin the next school year making recommended adjustments to assist them in meeting their consortium goals. In the final year of the project, the evaluators will assess the sustainability of the projects in each school, the implementation of the process of community driven, project based, on-going curricular reforms in the schools, and the transformation of the schools' curricula.



Rural Challenge
Mars Hill Conference
on
Place-Based Education

TennGaLina Consortium
June 7,8,9, 1999



UNIT 1st Grade Level - Subject: Math
Submitted by: Susan King, Doris Hensley

Objective: Counting money up to a dollar.

Activities: To recreate The Ducktown Company Store, students will buy and sell items with money amounts up to a dollar.

1. Students will accumulate the items stocked by the company store.
2. Students will price the items.
3. Students will role play (store clerks, customers, store manager and salesmen).
4. Students will buy and sell merchandise using correct money amounts.

Evaluation: Teacher will observe students making correct change and monitor and reteach as needed.

APPENDIX D

Possible Interview Questions:

1. Tell me about your experience as an educator (past schooling to the present).
2. Some people say that the way that you are taught in school is the way you will teach in school. If you disagree with this how do you differ from the way you were taught?
3. Which of the following would best capture your view on the role of teacher and learner in the mathematics classroom: **teacher as an instructor**---learner as master of skills and procedures, **teacher as explainer**---learner as passive receiver of knowledge (empty bottle to be filled), or **teacher as facilitator**---learner as active in construction of meaning.
4. As a teacher, do you see yourself as the “sage on the stage” or the “guide on the side”?
5. Which of the following do you more closely associate with the purpose of schooling: the explicit purpose of education curriculum is to develop a standard set of skills to be mastered so you can get a job in the global market, or the explicit purpose of the education curriculum is to produce informed citizens ready to participate in the immediate community?
6. What was your earliest recollection of the ARC? How was the project introduced to the school curriculum? Were you coerced (forced) or enticed to participate?
7. The ARC scouts were looking for schools that were “genuinely good and genuinely rural.” They picked Van Buren to participate. Did the school continue to do what they were doing and document what they were doing or did outside experts come in and suggest different methods of teaching to the faculty?
8. Where you involved in any phase of the administration of the ARC project? (the initial planning, the implementation, the portfolio, evaluation, etc).
9. The Annenberg project promoted the connection of schooling to the community. How did a typical class incorporate the community into the classroom? What were the steps (was there a model or module)? Did every lesson contain a rural component?
10. In typical math class the bell rings and the students settle into their assigned desk in their row. The teacher begins with a review of the homework, a lecture, and the assignment of homework. The bell rings and the students leave. Was that any different in your classroom during the ARC period?
11. Did you feel you could deviate from the State or school’s prescribed curriculum? Did you have freedom to teach things other than the standards?
12. In what way(s) did you change your teaching methods (or amend)?
13. Some schools offered grants to teachers who participated in ARC efforts. How did your school promote participation?

14. As a mathematics teacher, did you think mathematics was a focus of the reform? Were you given any additional help in integrating school math with the community?
15. At Copper Basin, I used some of the works of James Lewicki ("100 Days of Learning in Place") and Milton Payne ("Using the Outdoors to Teach Mathematics") to develop my teaching practices in the ARC. Becky Mobbs looked back at her experiences in 4-H for guidance. Did you use any works of others to guide you (if so who?) or did you rely on your own experiences?
16. Was the community brought into the classroom or was the classroom taken to the community (both or neither)?
17. The NCTM Standards came out about the same time as the ARC program was initiated. Some people believe that curriculum based on place can be integrated with State and national standards and others believe that place and standards are incompatible. What do you believe?
18. Did the ARC make a difference with you personally and/or your school? Was there any residual effects or programs? If so, describe the effects or program.

APPENDIX E

INFORMED CONSENT FORM

DESSERTATION

The Annenberg Rural Challenge Ten Years Later: Looking for a Place for Mathematics in a Rural Appalachia Place-based Curriculum

INFORMATION

You are invited to participate in a research study. The purpose of this study is to gather and analyze data from the TennGaLina Annenberg Cluster to see how mathematics was treated in the program, what approach was used to address pedagogy and curriculum, and the residual effects.

Selected former students, teachers, administrators, stewards, and community members of the TennGaLina Cluster will be interviewed during the Fall of 2007 and the Spring of 2008.

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 AND RISKS

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. There are no foreseeable risks associated with participation in this study.

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.

_____Participant's initials

CONTACT

If you have questions at any time about the study of the procedures, you may contact the researcher, Craig Green, at (423) 496-2722, or copperbasin@hotmail.com. If you have questions about your rights as a participant, contact the Research Compliance Services section of the University Of Tennessee, Knoxville 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_____

Researcher: Craig Green

Researcher's signature_____

Vita

Craig Green was born March 16, 1959 in Maryville, Tennessee. He attended school at Mentor Elementary and Friendsville High School in Blount County, Tennessee. Upon graduating high school in 1977, Craig enrolled in the University of Tennessee, Knoxville and graduated with Bachelor of Science degree in Joint Elementary-Secondary Mathematics Education in 1981.

Craig was hired in August of 1981 Copper Basin High School where he was a secondary mathematics teacher for 26 ½ years. During this time span, he received Master's of Science degree from Tusculum College in 1995 and Education Specialist degree from Lincoln Memorial University in 1997. He currently is Teacher Associate with the Tennessee Governor's School of Mathematics and Science.

Craig began the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM) doctoral program in the summer of 2002. He received the Doctor of Philosophy degree with a concentration in mathematics, mathematics education, and rural education from the Theory and Practice in Teacher Education department at UTK in the summer of 2008.