THE ROLE OF TRIBAL ELDER IN TEACHING CALCULUS THROUGH AN ETHNOMATHEMATICAL LENS

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ROLE OF TRIBAL ELDER IN TEACHING CALCULUS THROUGH AN ETHNOMATHEMATICAL LENS

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ABSTRACT

In action research study I was the classroom teacher of high school-aged African American students participating in the six-week summer portion of the Reach Up program. The purpose of Reach Up is to help students improve study skills, build confidence, motivation, self-discipline, maturity and better grades so that they can go to the college of their choice. Students selected have demonstrated academic promise, are "first-generation" college students, and have been selected from the city's urban core high schools. This study examined the relational and instructional dynamics that took place in the classroom in which the curriculum was developed through an ethnomathematical lens. Ethnomathematics is grounded in the Freirean model of valuing the intellectual contributions of marginalized cultures and using these contributions to teach for liberation.

This study introduces the culturally responsive strategy of teaching as the "Tribal Elder." A Tribal Elder is one who is a leader in the community, who knows how to navigate the outside world to ensure survival, is related to the students by kin, and is trusted by the students and their parents. How these relations were built, while at the

same time engaging the students in high-level mathematics is reported. It was hoped that unpacking my teaching and investigating from the inside would lead to further development of the theory of the mathematics teacher as Tribal Elder in the classroom and could then be emulated by others.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Graduate Studies, have examined a dissertation titled "The Role of the Tribal Elder in Teaching Calculus through an Ethnomathematics Lens," presented by Robert Riggs, candidate for the Doctor of philosophy degree, and certify that their opinion is worthy of acceptance.

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ACKNOWLEDGEMENTS

I would like to thank Dr. Rita Barger, my adviser and friend, for her patience, timely insights, and encouragement throughout this entire process. She let me try new things and even fail, because she understands that true knowledge and understanding comes more from our failures, than from going down the well trod road of "playing it safe." I would also like to recognize the hard work of the committee. Your invaluable, and at times brutally honest, input helped me grow as a scholar and as a person.

This project would never have happened without the assistance of the Upward Bound staff. I want to thank the Director, Ms. Natasha El-Scari, the curriculum coordinator, Chris Shobe, and the indomitable Katherine Painter, the administrative assistant to the program for allowing me to make your kids a part of my life and this study.

Lastly, I'd like to thank Dr. Michael Kruger, chair of the physics department, for providing me with the "space" I needed to finish this undertaking and for his well-timed words of encouragement.

DEDICATION

This research product is dedicated to a person, a group, and to a lasting memory. The person of course is my wife, Ann, who without her support and uncanny knack for keeping this divergent thinker on task, I never would have completed this project. Now I can become a "Weather Watcher" and any other silly pursuits I conjured up over the past five years, that would have led me astray. But, Ann, like a good train engineer, kept me on track. For that, and just for being my "very best friend", I dedicate this work to her.

The group is all those urban kids out there who each day, get up, make their way through some scary streets, they probably walk their little brothers and sisters to school first, and then they go into their high schools, where the first thing to greet them is police officer, a metal detector, and a uniform inspection. But they go through this everyday. They make that commitment and effort to show up each day, yet, each day the system time and again reminds them, in case they forgot, that they are a "problem" to the rest of society. Undaunted they still come. They come because they want to learn. To these kids, this project is also dedicated.

Lastly, the memory is to a mathematics teacher who taught in my junior high and also attended my church, Mrs. Lillian Schumacher. One day she handed a goofy fourteen year-old kid a small certificate, that said Bob Riggs somehow was inducted into the National Junior Honor Society, of which "Miss Lillian" was the sponsor. She said to this gangly teenager, "Now Bob, look at me." I did. "Now, I want you to take this home, take care of it, and someday hang this next to your Ph.D. Do you understand?" I nodded, but it wasn't until I started this project, I really understood what she was saying. This

project is also dedicated to all the Lillian Schumacher's out there who take all children, and teach them math, including my maternal grandmother Ruth Christensen. She taught all the children of Axtell, Kansas algebra except maybe…my mother. My mother taught me something more important than mathematics, and that is that all children deserve a caring teacher—which she was.

CHAPTER 1

INTRODUCTION

In August Wilson's play *Radio Golf*, Harmond Wilks, a young, ambitious, ivy-league educated, African American businessman returns to the blighted Pittsburgh neighborhood of his childhood as a redeveloper. While Harmond is frantically trying to juggle his marriage, his business, and his budding race for mayor, he has frequent run-ins with an old friend he used to "hang" with, Sterling Johnson. Sterling has never left the 'hood' and makes ends meet by being a handy man. The dark irony in the play is that Harmond's aspirations are tied to whether or not the old neighborhood will be considered a "blight" on the city. If his neighborhood meets that designation then the federal dollars will pour into Harmond's coffers. Sterling questioned Harmond's motivations early on in the play. He could see that Harmond was "selling out" and was doing things the way the White world did things. Sterling, suspiciously, asked Harmond if there would be any jobs for folks in the neighborhood if the "blight" money came in because Sterling was looking for work and in a union. Harmond guaranteed his friend there would be work and it would pay union wages. Below, we take up where Sterling has returned to see if his friend will honor his promise of finding him work.

HARMOND: When I called the union and tried to get you on the job they said you weren't a member.

STERLING: Naw…you don't understand. I'm my own union. I got my own everything. Except my own bank. But I got my own truck. I got my own tools. I got my own rules and I got my own union. I don't play no games. I have to have my own.

That's the only way I got anything. I've been going through the backdoor all my life. See, people get confused about me. They did ever since I was in school. But I know how to row the boat. I been on the water a long time. I know what it takes to plug the holes. I ain't dumb. Even though some people think I am. That give me an advantage. I found that out when I was in the orphanage. Mr. Redwood taught me that. He told me, "You ain't dumb, you just faster than everybody else." I was so fast it made me look slow. I was waiting for them to catch up…that made it look like I was standing around doing nothing. They kept me behind in the fourth grade 'cause I wouldn't add twelve and twelve. I thought it was stupid. Everybody know there's twelve to a dozen and twenty-four to two dozen. I don't care if it's dough nuts or oranges. They handed me a test and I turned it in blank…"

The rhythm, pace, and storytelling ability of the characters August Wilson creates hooks the audience at the outset. However, at this juncture in Sterling's speech I was leaning in even closer. I was also chuckling to myself, because I have seen over my career of teaching in the urban core, many a hapless teacher stare dumbfounded as one of their 'Sterlings' throws his Missouri Aptitude Placement test on the floor. Sterling continues…

STERLING: If you had seventeen dollars and you bought a parrot for twelve dollars how many dollars would you have left? Who the hell gonna spend twelve dollars on a parrot?

At this point, the entire audience erupted in laughter. The audience that night was a nice mix of African American and white theatergoers and everyone laughed at the joke, but there was a smattering of a few, very quiet, "A-mens" whispered by some. After

having taught the Sterling Johnson's of this world for many years, I said a quiet "A-men" too. Finishing the speech, Sterling eloquently lays out the absurdity of his schooling.

STERLING: What you gonna do with it? Do you know how many chickens you can buy for twelve dollars? They thought I didn't know the answer. Every time somebody come to adopt me they say, "Well, Sterling's a little slow." That stuck with me. I started to believe it myself. Maybe they knew something I didn't know. That's when Mr. Redwood told me, "You ain't dumb, you just faster than everybody else." I've been going in the back doors all my life 'cause they don't never let me in the front."

Some researchers might claim that Sterling is having a problem with his *mathematical identity* caused by his lack of *mathematical socialization* (Martin, 2000). This claim is substantiated by volumes of research on the mathematical identity, or lack of mathematical identity and socialization of African American students (Berry, 2006; Cobb, Gesalfi, & Hodge, 2009). A byproduct of this student centered research is that it gets educators, researchers, and teachers, to focus on changing the students, rather than examining the teaching and classroom interactions that take place. Another more pernicious consequence of focusing on the students' mathematical socialization and mathematical identity is that it could lead to more deficit theories being piled on African American students and their ability to learn high level mathematics. Teachers and teacher educators have a tendency to use the findings in identity research as an indicator that the student needs to be changed. What doesn't change then is the instruction.

The purpose of this research is to examine not how we can get a group of African American high school students to change their mathematical identity, but rather how the teacher can adapt, or in a very literal sense re-socialize him or herself into assuming a

role less authoritarian[1], and establish a setting in the classroom that is more familial (in a graduate school setting it might be construed as collegial—but that is not exactly appropriate for teenagers). The teacher assumes the mantle of Tribal Elder in the classroom (Lipka, Hogan & Webster, 2005). The role and duties of the Tribal Elder are described in detail later in this chapter. After spending ten years teaching in the urban core of a Midwest city, I have seen African American students who many might have considered incapable of learning, actually learn, retain, and *use* mathematics at a very high level. The reason for most of this success belongs to the students. Yet, there must have been something that I was doing in the classroom that was different that promoted learning. What was it? Cochran-Smith calls that "it" the "black box" of teaching (Cochran-Smith, 2005). She of course is referring to the black box recorder that records all the radio transmissions and cockpit conversations on a commercial airliner during the flight. Not only is the black box the first thing salvagers look for after a tragic accident so that FAA officials can "reconstruct" what was happening between the aircraft and the tower, but it is instrumental in the training of the pilots and crew. The pilots listen to the recordings and bounce off what was said with their logs so that any mistakes can be corrected for the next flight. This is the type of self-analysis that professionals do. Pilots adjust to the weather, the type of aircraft they're flying, the number of passengers and amount of cargo they're carrying to ensure a safe flight. I propose that teachers need to adjust to the dynamics and culture of the classroom where they teach, rather than forcing

[1] *Authoritarian* is not pejorative in this context. It is not meant to bring to mind top-down, lecture format type teaching. In today's high schools, almost all classes, whether traditional or constructivist, are authoritarian because the teacher is the final arbiter in all things. The teacher sets the mood, tone, and dynamics of the classroom, based on the social norms of the teacher. The students must conform to the teacher's culture.

the classroom to conform to the teacher. Attempting the latter is akin to a pilot wishing it was a sunny day, though it is storming, so she flies the plane as if it is a crystal clear day. That is dangerous and could endanger the lives of the passengers. I firmly believe the stakes are just as high for our students in the urban classroom[2] as they are for the hypothetical passengers. This action research project is an attempt to unpack the black box of my teaching. The actions of other effective teachers are also examined.

In addition to researchers claiming the Sterling character from August Wilson's play had issues with his mathematical identity and mathematical socialization, one could also make a very strong case that his teachers also had a problem with introducing mathematics in a culturally responsive way which would have led to a more developed mathematical identity and mathematical socialization (Barton, 1996; Eglash, 1997; Eglash, Bennet, O'Donnell, Sybillyn, & Cintorinna , 2006; Ladson-Billings, 1994 & 1995; Lipka et al, 2004; Leonard, 2008; Martin, 2003; Stinson, 2006; Zaslavsky, 1999). The lack of understanding on his teachers' part led Sterling to give up on mathematics.

The heated exchange between two characters in the play illustrates the friction between the current research, teacher's attitudes, and the needs of our marginalized students. That friction frames the research problem of this project. Sterling didn't answer his math teachers' questions because he was dumb. In fact the playwright, August Wilson, went to considerable lengths to portray Sterling as incredibly smart and

[2] As I write this, I just received notification of funeral arrangements for one of my former students in the "Rise Up" program. He had "made it" and was about to start his sophomore year of college when a bullet struck him while he was protecting two smaller children from an argument.

wise[3] (Ogbu, 1978; Steele, 1997). He was wise enough to see through the ways of schooling. He knew the school game was rigged (Davis & Martin, 2008; Gutierrez, 2000; Hilliard, 2003; Hollins et al, 1994; Ladson-Billings, 1995; Martin, 2003; Ogbu, 2004; Stinson, 2006).

I have taught many 'Sterlings' and have seen bright and capable students, who during my class discovered their hidden "math gene" only to abandon mathematics later in their high school career. Martin (2006) characterizes this phenomenon of abandoning mathematics as two sides of the same coin. One side is that marginalized students fail to recognize the usefulness of mathematics in their lives, and the flip side reveals to them a world where the predominantly white teachers fail to give the marginalized students credit for what they do know. In other words this *racialized mathematics* happens when the culture of the room either makes the students uncomfortable, or completely ignores them and their mathematical production because many times the teacher already has a preconceived notion that the students are bad in mathematics, and there is nothing the African American student can do to change that notion. The natural tendency for anyone laboring at a difficult subject is to give up, especially, if you are doing it right, yet the "expert" does not affirm your abilities. Thus the students don't see the usefulness of mathematics in their lives because their ability to do mathematics is not valued by their teachers—or left uncommented on—and their ability to do mathematics is not recognized by society as something we want students of color to do (Walker & McCoy, 1997).

[3] In this context "wise" means one has the uncanny ability to see through the ways of the world; especially the hypocritical ways of the dominant culture. Being wise is the ability to play the game at times, and yet, be able to not play at the game when you see no point. In other words, playing along will net you nothing.

Leaders within the African American community also had these problems in school. Thus in some communities there exists a devaluing of any mathematics that goes beyond the basic utility of balancing a checkbook, finding a simple percent, or checking a pay stub (Martin, 2000). A third factor is how schools are constructed for the learning of the dominant culture (Hilliard, 2003; Martin, 2008; Perry, 2003d). Nearly all of the historical figures the students see over the span of their mathematics education are white and male. Seldom are the contributions of Africans or African Americans mentioned, which robs the students of identifying mathematics with their culture. Mathematics, to the students, seems like a "white thing."

When the less resilient African American students gave up on mathematics, researchers often wonder, what else are they giving up (D'Ambrosio, 1999; Gutierrez, 2000; Gutstein, 2003; Kitchen & Becker, 1998; Moses & Cobb, 2001, Martin, 2000; Tate, 1997)? One thing they may give up is earning power. As our society becomes more high tech, mathematics is a gatekeeper to economic freedom in this high tech society (Barton, 1996; Bell et al, 2004; Berry, 2008; D'Ambrosio, 2001a; Moses & Cobb, 2001; Stiff & Harvey, 1988). I urge caution on this point. I concede that the average earnings of those who chose a mathematics intensive major in college are substantially higher than those who did not (Carnevale, Smith & Strohl 2011). However, is our collective motivation as a society to improve the mathematical abilities of our marginalized students, based on the desire of the United States to remain the world economic leader? Also found in the Georgetown study was white workers and men fare best. Even in their highest paid major, electrical engineering, blacks earn $12,000 less a year on average than Asians and $22,000 less than whites with the same major. If that is

the case, then we need to examine how this drive for economic dominance has impacted our citizens of color over our nation's history. Reflecting on the historical aspect we will see that our drive for world economic dominance has come at the expense of our marginalized cultures (Hilliard, 1995). One problem with framing the need for improving the mathematical education of our marginalized students around the economic dominance of the United States has a tendency to lead to market-based approaches for fixing societal ill which the literature demonstrates this way does not address social justice issues. In fact, market based approaches exacerbates the gulf between the "haves" and "Have nots" (Cochran-Smith, 2005).

Cochran-Smith (2005) argues that market-based fixes only help those that are already well off, because in this competitive environment there are winners and losers for scarce resources. Examples of market-based fixes are school vouchers to parents whose children are currently attending underperforming schools so they can afford the tuition at a supposedly "better" private school; or as in the movie "Waiting for Superman" wants us to re-direct resources to these marvels of education, the charter school. Thus a scarce resource, funding, is made even more scarce in a neighborhood where every penny counts. Another example of a market-based approach to fixing education is to remove barriers of entry into teaching for career changing professionals. The idea is that by dispensing of the supposed draconian certification requirements for teachers[4]—and again this is especially true in math and science—we can fast-track "qualified" personal into the classroom. The problem with this thinking is that well-funded districts can pick and

[4] This is not to make the argument that the state certification requirements make for an exemplary teacher candidate.

choose their teachers and take those who have had training, and the poor districts are left to hire well-meaning career changers with no experience or training. Usually these teachers are hired based on having been accepted into an alternative certification program, though they have not completed it.[5] Thus we have a scarce resource, qualified teachers in science and math, becoming scarce in the urban schools. An alternative is for society to work collectively to solve problems and share resources. The best way for a society to participate in this collective action is to have well-educated people, from the city, farms, and suburbs that have the analytical skills to look at complex issues and develop non-hegemonic courses of action.

Another issue related to racialized mathematics is that current school curricula in mathematics appear irrelevant to students of color (Davis & Martin, 2008; Eglash et al., 2006; Gutstein, 2006; Hilliard, 2003; Hollins et al., 1994; Ladson-Billings, 1995; Leonard, 2008, Martin, 2007; Tate, 1997; Zavlasky, 1998). This is why Sterling's comment about the $12 parrot rang true for much of the audience. Many African American students see mathematics as something others do. They do not see themselves as mathematicians. They lack a mathematical identity (Martin, 2000). This lack of mathematical identity can permeate the African American community thus turning the entire population and future generations off from mathematics. Martin (2000) defines this phenomenon of how the culture views the usefulness of mathematics as the mathematical socialization of students.

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[5] It should be noted that in her dissertation research conducted by Dr. Waters she found that alternative certified teachers performed (based on reviews and student test scores) just as well as traditionally certified teachers. However, these were teachers who completed an alternative certification program. Many begin and do not finish, and once they do, they leap to a suburban district as soon as they are "qualified."

What was hoped would be an helpful offshoot of this research has been a plethora of curricular materials that aspire to promote the use of culturally relevant mathematics in the classroom (Egalsh et al., 2006; Gutstein, 2006; Leonard, 2008, Strutchens et al., 2004). The thinking is that these culturally situated lessons might diminish the effects of the racialized mathematics and negative mathematical socialization children of color have experienced. Many of these materials are quite impressive and just might prove quite effective in the hands of an expert. However, as a practitioner working on my own, I found some of the materials might have served the students better if I had had some professional development with the material, even though I spent several hours planning the lesson.

An excellent example of a culturally situated unit on mathematics is the African Fractals unit developed by Eglash (Eglash et al., 2006). The unit examines the fractal patterns of African cornrow braiding. The unit caught my attention because fractals represent the "new" mathematics that D'Ambrosio espouses, rather than the dead mathematics that students don't need any longer. Along with the mathematics, the social and historic significance of African cornrow braiding is discussed. The website contains everything a teacher would need for teaching the unit. Though the web-based teacher materials are thorough, serious consideration of the learning curve for the teacher and students to learn fractals must be taken into account before starting this unit. If I was going to teach in-service teachers about this unit during a professional development period, I would consider carefully if this unit may be a bit much to ask of a harried classroom teacher.

When I tried this unit with my own Reach Up students one summer, much of the summer was spent building them up to a level where they could comfortably talk about fractals. The summer session is only five weeks long, and we spent the first four weeks studying recursive processes, iterations and what those mean, geometrical transformations through scaling, reflections, glides, glide reflections and a whole host of other abstract geometric and algebraic processes the students had never been exposed to until that summer. The students were engaged, and I was very comfortable teaching them the mathematics they would need for the African braiding unit. When we finally got to the part of African braiding, the instruction fell flat. This was due mostly to my lack of cultural background of cornrows and my unease with teaching history and bringing up the slave trade that were the social and historical portions of the lesson. I have found I can read about emancipatory teaching and the need to instill within your students the ability to analyze the injustices of their current situation so that they can become change agents in their community. I get that. But when this white man of privilege tries to teach injustice, it rings false to me. I can feel the tension grow in the room, where none existed before. I can sense the students themselves becoming uncomfortable. Akeesha expressed her discomfort in a moment of pique when she burst out with, "I hate this Black White stuff! It makes my stomach hurt." I could not wait to get back to just the mathematics.

Akeesha's vocalizing of what I guessed everyone in the room was feeling gave me pause. It forced me to examine what I was doing as a teacher trying to provide an emancipatory or liberating mathematical experience. I began to question the literature on multicultural education (to include both culturally relevant pedagogy and culturally

responsive teaching which I define in detail below) and what it was doing to our marginalized students. Was it the framework of multicultural education or was it me, a white teacher, that was the problem? I began to wonder about teaching the kids about being change agents. Don't get me wrong on this point, I am not advocating we keep our marginalized urban students ignorant so they won't rise up against the injustices being perpetrated upon them, but I began to wonder what happens after we carefully lay out an injustice in society (the simple blurb about salary differences from the Georgetown study is an example) and we fire up the kids' anger, i.e. "make their stomachs hurt." What happens next? Can we fix the problem? Probably not. So then what? These questions allow me to frame the purpose of this study and why teaching calculus was chosen.

The above was my experience with a rigorous, and culturally situated mathematical unit. Most of the other curricular treatments I've encountered have been long on social issues and very short on math. Though the lessons or units were well-meaning and, I believe, for the designers of these materials they were quite effective in their teaching experience, I found that most of them boil down to some rather simple calculations and statistical inference. Rigorous mathematics is missing, though in fairness it should be pointed out that the ability to make statistical inferences and use mathematics in your everyday life makes for a discerning and educated citizen. However, I don't think that it paves the way for the study of higher mathematics, nor does it show the abstract beauty of mathematics. A big part of my motivation in teaching high school students, or a person of any age, mathematics is to show them the beauty and wonder found in mathematics (thus my affinity for the African Fractal unit). I have grown weary of the dominance of the utilitarian use of mathematics in our classrooms,

and not the study of mathematics just for mathematics sake. We have allowed the frustrated student mantra of, "When am I ever going to use this?" to bully us into advancing the use of mathematics as a tool, rather than as an intriguing field of study that stretches the imagination. Thus we promote "dead" mathematics.

Jonathan Kozol's *Savage Inequalities* (1991), opens the reader's eyes to how American society treats the poor, Black, Hispanic, and disenfranchised in this country. In addition, White, middle-class teachers, fail to recognize the institutionalized racism that is rampant in our educational system nation-wide (Kincheloe, 2001; Ladson-Billings, 1994). Ninety percent of teachers in the United States are white.[6] These teachers, when faced with African American students in the classroom, are much more concerned with classroom management and behavior modification than with subject matter (Tredway, 1999). Thus education reform faces a dilemma of a heterogeneous student population (African American, Latino, and Pacific Islander) with a very homogenous teacher population. The homogenous teacher population quickly falls back on extensive use of behavior modification rather than teaching where the focus is on changing the child instead of the teacher adapting to the culture of the children in the class. This forces the teacher and the students both into an adversarial relationship rather than one of community. This leads to a curriculum which does not stimulate children of color to be critical thinkers, much less for these children to see the relevance of mathematics in their lives (Barton, 1996; D'Ambrosio, 1999 &2001; Gutierrez, 2000;

[6] An unintended consequence of *Brown vs. Topeka* was the loss of jobs for African American teachers (Hilliard, 1994b.). This loss was actually predicted by W.E.B. Du Bois as well as the general malaise surrounding urban education for the poor. The all-Black schools were closed and these teachers were not hired in the white school districts. In addition, *Jim Crow*- type teacher certification requirements were quickly passed in states throughout the country. This further barred access to teachers of color from entering the job market (Leonard, 2008).

Gutstein, 2003; Hilliard, 2003; Hollins et al, 1994; Ladson-Billings, 1994 & 1995, Lipka et al, 2005; Leonard, 2008; Martin & McGee, 2009; NCTM, 2000; Powell, 2002; Stinson, 2006; Tate, 1997; Tredway, 1999).

The motivation for this research project comes from my years of experience teaching mathematics in "alternative" urban high schools. In my first year, I grasped that these students, predominantly African American and on free or reduced lunch, were smart and capable. Though many had remedial math skills at the beginning, some were very good at math, and all eventually began to enjoy math class. A hardcore "constructivist" would probably have considered my pedagogy poor. It was very non-*Standards,* somewhat authoritarian, and Friere (1970) might have held it up as a model of what the "banking" system of education looks like. But I noticed that through building relationships, using their language—though this always brought snickers from the class—and just listening to them, my students began to do rather high-level mathematics and on the surface appeared to enjoy it. Frequently in my class I'd hear comments such as, "This is my favorite class." Or "I never liked math before, but now I get it."

There was something in the "doing" of mathematics that motivated these students. I noticed something else about my students; their post-test scores on the SAT-9 achievement showed remarkable improvement (D. Lehman, Personal Communication, May 30, 2009). These students who had never done well on standardized tests now excelled. They won, finally, at the dominant culture's game.

The literature supports that there are significant positive associations with culturally relevant pedagogy in mathematics classes (Baron, 1996; D'Ambrosio, 2001b, Eglash et al, 2006, Frankenstein, M., 1990; Kitchen & Becker, 1998; Leonard, 2008;

Zaslavsky, 1999). Yet the current climate in most schools is oppositional to even teaching multicultural mathematics because most mathematics teachers view their subject as culturally neutral (Olson, 2009). Ethnomathematicians point out that the mathematics of a people is deeply rooted in their culture (D'Ambrosio, 2001a). Cognitive and constructive theorists have pointed out that grounding instruction in a students' culture leads students to create new knowledge (Saxe, 1991).

Statement of the Problem

The underachievement of U.S. students in mathematics is a national problem that has vexed researchers, policy makers, teachers, and parents for decades. Trends in Mathematics and Science Study (TIMSS) data continue to show lower achievement among U.S. students on the international level. Comparisons of African American students to White students in the U.S. show the former consistently scoring lower on the National Assessment of Educational Progress (NAEP) results for eighth graders show 59% of Black and 50% of Hispanic scored below basic in math (Hilliard, 2003 & Leonard, 2008).

When socioeconomic status is examined the situation becomes worse. Studies show that students ineligible for free or reduced lunch scored much higher in mathematics achievement than those who receive free or reduced lunch. Leonard (2008) points out data from the Statistics from the Child Poverty Fact Sheet of 2001 shows that poor students are more likely to be Native American, Black, or Latino/a. This implies that these children are overrepresented in the lower achieving groups. As a result, these children begin to disappear from the mathematics pipeline as early as elementary school (Leonard, 2008).

The main-stream press, civic leaders, school administrators, and practicing teachers have been focusing on the achievement gap for so long and ignoring the underlying causes, that in the extreme case, many of our marginalized children of color and their teachers believe that these children can't do mathematics (Berry, 2008; Davis & Martin, 2007; Gutierrez, 2008; Kitchen & Becker, 1998; Ladson-Billings, 1997; Hilliard, 2003; Martin, 2007; Perry, 2003a). Thus, our African American children experience mathematics in highly racialized contexts.

In addition to the discussion above, racialized context means we examine "blackness" not as an excuse, but as a salient attribute of race and racism in school, their life, and mathematical experiences. As mentioned earlier, the system is not designed for African American children to learn—as it is designed for white European children (Martin, 2006). Once practitioners recognize the hegemonic lens that informs the curriculum in which they engage their practice, it is hoped a transformative experience will take place. An important goal of the research described here is to provide practitioners with an instructive counter-example of practice that teaches high mathematics, yet is informed by the culture of the students.

In the high stakes testing environment caused by the No Child Left Behind legislation (United States Department of Education, 2003) research has shown that a preponderance of the mathematics education and curriculum in large urban districts serving predominantly African American and Hispanic students has been aimed at "teaching towards the test" (Berry, 2008, Eglash, 2006, Gutierrez, 2000& 2008; Davis & Martin, 2008; Hilliard, 2003, Kincheloe, 2004; Martin, 2006; Perry, 2003a, Tate, 2004). These practices consist of remediation of skills, an overemphasis on drill and practice,

and canned curriculum, which severely limit teachers' freedom to provide what is best for their students (Hilliard, 2003). The practices mentioned above run counter to the National Council of Teachers of Mathematics *Standards* for teaching mathematics (NCTM, 2000). Current curricula for African American students are those that have been developed to meet the needs of a white male dominated society and not the needs of African American students in urban districts (Martin, 2003). It is a curriculum where the students—at best—are passive receptors of authoritarian instruction, or—at worst—oppositional to the instruction (Cobb et al, 2009; Ogbu, 2004). To be successful in any endeavor, individuals must envision themselves as being what they are doing. A successful vocal student sees herself as a "singer." A student successful in history does his or her own research and "sees" himself as an historian. In both cases the students have either a musical or historic identity. These students—the singer and historian—have strong positive "agencies" with their subject. Being a passive recipient or oppositional to the study of mathematics is not a mathematical identity that fosters success (Boaler & Greeno, 2000; Cobb, 2009; Holland et al, 1998; Hollins et al, 1994; Kitchen & Becker, 1998; Martin, 2000; Ogbu, 2004).

Due to the negative mathematical socialization they have received, many African Americans see no use for higher mathematics (Berry, 2008, Eglash, 2006, Gutstein, 2006, Leonard, 2008, & Martin, 2000). However, as reported by Devlin (1998) "completion of a rigorous program of mathematics at high school pays huge dividends when any student enters the work force or goes to college, regardless of what profession or course of study the individual chooses. This effect is even greater for low-income students." Devlin cited a U. S. Department of Education white paper titled, "Math Equals Opportunity." The

study showed that 71 percent of low-income students who took algebra and geometry went on to college, whereas only 26 percent of those who did not went on to college. Also, 83 percent of all high school students who took algebra and geometry courses went on to college. That's more than double the rate (36 percent) of students who did not take these courses.

Students who took an additional course beyond algebra II doubled their chances of completing college. In addition, for low income families, where many of the students either don't have access to higher mathematics courses or they don't see the need, only 1 in 17 students who start college finish (Dothcart, 2005). By way of comparison, 94 percent of students from high-income families, and 84 percent of students from middle-income families who took first-year algebra and geometry in high school went on to college. Almost two-thirds of students who complete a second year course in algebra while in high school—just complete the course with a C or better—finish a four-year college degree within six years once they start college. This is regardless of the race of the student (Devlin, 1998). Add to these findings the fact that Moses and Cobb (2001) see learning higher mathematics as a gateway to economic freedom. Persistence is the ability to continue in mathematics even though it is a struggle both academically and culturally (Walker & McCoy, 1997). Taking higher level mathematics teaches persistence. Many researchers claim that the current academic climate in U. S. schools does nothing to bolster marginalized students' persistence (D'Ambrosio, 2001a, Davis & Martin, 2008; Eglash, 1999, Ladson-Billings, 2006; Martin, 2003; Tate, 1997; Stinson, 2006).

Exacerbating these problems is the level of mathematical content knowledge of teachers in urban schools (Ball & Bass, 2002; Davis & Martin, 2008; Hilliard, 2003, Martin, 2007; Tate, 1997). A majority of the teaching that takes place in the urban schools involves low skill and rote memorization of numerical facts. Much of this sophomoric curricula is directly related to the training of the teachers (Ball & Bass, 2002; Gutstein, 2003; Martin, 2007, Tredway, 1999). Our marginalized students are capable of learning high-level mathematics. Yet it is not taught in many urban schools. Again the administration, mathematics department chairs at the high school and middle school level, and the teachers time and again point to deficit learning theories as reasons they can't teach "these" students higher mathematics and that these students are better off "mastering fundamental skills" (Ladson-Billings, 1997; Moses & Cobb, 2001; Orey & Rosa, 2005).

There have been attempts to introduce high level mathematics in the urban schools, sometimes even at the elementary level, that have met with much success (Hilliard, 2004). However, due to funding constraints the programs are dropped just as the programs begin to get traction. In addition to funding, some of these programs required a profound understanding of rigorous mathematics which limited the program's success. In other words, many of teachers were not trained mathematicians (Hollins, Smiler & Spencer, 1994). Other programs that have been tried with success are Saturday Academies where the students are given mathematical enrichment in algebra II and pre-calculus courses in preparation for college. These programs have also been successful, yet once again, finding the resources for 'extra' schooling is taxing to already limited resources (Hofstetter, Kolitch,, & Bell, 2004).

Researchers warn though that any discussion of achievement using standardized scores must be guarded. An example of where the data may be suspect is that the drop out rate for African American, Hispanic, and Native American students is much higher than that of whites. Dropout rates for a number of reasons are greater at the higher ages. Thus the data for 9-year-olds may be representative, but that for 17-year-olds is clearly not (Secada, 1992). Anecdotally, this researcher has witnessed several Latinas who were outstanding mathematics students, yet they quit school upon reaching fifteen or sixteen years of age because of the strong strong cultural pull for them to take care of the smaller children so all the adults could work. These bright students then are not part of the Hispanic data set in later grades.

Purpose of the Study

There has been much written on the culturally relevant pedagogy in mathematics education (Cobb, 1994, Ladson Billings, 1994, Leonard, 2008,Moses & Cobb, 2001, Tate, 1995,) and that instruction trumps curriculum (Hilliard, 2004). However, as Leonard (2008) states: "While there is a lack of research studies that examine culture as a basis for learning mathematics, Demmert and Towner's (2003) meta-analysis highlights several research studies that show promising results." She goes on to discuss studies done with small children, etc. but none dealing with high school or with mathematics. Later, on the same page (p. 11) she says, "Quasi-experimental studies on the use of culturally based education in mathematics classrooms, however, have been difficult to conduct."

The above gives a partial basis of my research objectives, but there is really just one purpose for this study: I want to know what it is that I do in the classroom that

makes urban kids want to do mathematics. That seems rather bold, maybe even arrogant, but I have evidence that there is something in my teaching, where I appear able to build the relationships required to teach mathematics to urban high school students at a high level. When I taught in some of the "toughest" alternative schools in the city, why did I get some of the most incorrigible students to skip gym, and come to my classroom? Why did I wind up with 33 kids in my class when another veteran teacher with the same credentials and same ethnic background of the kids only had 6? Why did my "alternative kids" excel on the MAP test—all nearing proficient or higher, a few actually proficient—when the rest of the school and the city did abysmally? Though these are not research questions, they provide the framework from which to design the study. The purpose is to carefully examine my classroom and apply qualitative methods of inquiry to my teaching and determine if culturally relevant responsive teaching takes place, or if some other phenomenon emerges that makes the students want to do mathematics. This research is practitioner focused where insights gleaned can be passed along to other practitioners. This study is a phenomenological case study that will contribute to the body of knowledge for using culturally relevant teaching in a classroom African American students.

The National Research Council issued a report in 2001 defining mathematical proficiency lists as follows (as cited in Walshaw & Anthony, 2008, p 519)

- Conceptual understanding: comprehension of mathematical concepts, operations, and relations
- Procedural fluency: skill in carrying out procedures flexibly, accurately, efficiently, and appropriately

- Strategic competence: the ability to formulate, represent, and solve mathematical problems
- Adaptive reasoning: ability for logical thought, reflection, explanation, and justification
- Productive disposition: habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's efficacy.

The above represents a culturally neutral paradigm of mathematics and teaching. The research in this paper is grounded in the critical notion that human interactions in the classroom, for the very sake that they are human interactions, can not be culturally neutral. Thus, in this research, evidence of these outcomes in the teaching will be investigated (Walshaw & Anthony, 2008):

- a sense of cultural identity;
- a sense of belonging;
- contribution;
- well-being;
- exploration; and
- commonly held values, such as respect for others , tolerance, fairness, caring, diligence, nonracist behavior, and generosity.

This research project examined the relational and instructional dynamics in two mathematics classrooms. The intent was to reflect and report on how supporting relationships are built while at the same time doing rigorous mathematics. And that by building these relationships and teaching higher level mathematics, the teacher is are

teaching marginalized students how to "navigate" the world, the educator is in essence acting as a "Tribal Elder" for his/her students.

There are several pitfalls that can occur when a teacher, especially a white teacher, is leading a class of marginalized students. One such pitfall I have observed happens when for the sake of "getting along," white teachers going to great lengths to establish a trusting and non-threatening classroom environment, while failing to teach rigorous mathematics. Another pitfall is having low expectations of their students which leads to not holding them accountable for their learning. White teachers in "black" schools either give students work that is so easy that it is degrading, or they give them grade-level appropriate work but either don't grade it, inflate the grade, or do not even care if the student turns in the assignment. This is a very subtle racism that white teachers fail to pick up on (Holbrook, 2010).

Teachers need to socialize the students into a larger mathematical world that honors standards for reasoning and rules of practice (Propkewitz, 1988 in Walshaw and Anthony, 2008). So there is an intricate dance, if you will, that partners relationship building with exploring of deep mathematical concepts. As in a dance, one movement of the body doesn't necessarily follow another movement. At times, many parts of the body are moving at once. This is the same situation between relationship building and teaching mathematics; they occur simultaneously at times and sequentially at other times. The art of teaching is to know when to emphasize one aspect or the other. But once the students are "with you" and are tackling the mathematics and speaking in a mathematical language, the teacher has provided a rich context for their mathematical socialization.

In this research project I wanted to avoid making the students and me uncomfortable with our differences in race. The mathematics is difficult enough, yet our race differences are a salient attribute of the classroom. Sometimes when trying to build relationships the desire of the teacher to "get along" and point out that we (as a white teacher) understand, can cause something we say or do to backfire, as happened in my class with Akeesha when she said that all this "black/white stuff made her stomach hurt.

This gave me pause. It made me start thinking of such questions as when we have students starting to think critically about their world and their place in it, are we "making their stomachs hurt?" The point is to give them the tools to become advocates of change, but at the age of fifteen, might they just feel powerless and overwhelmed? If done incorrectly, a teacher with the good intentions of trying to implement activities that are culturally responsive and relevant, can lead to the answer being "yes" to the two previous questions.

My natural inclination, and it might just be a "guy-thing" but I think it's a tendency of most people who go into teaching, is to "fix" the problems our students are facing. Or we want to "fix" our students. The intentions are good, but they can have harmful side-effects. One such side-effect is the "White Savior" syndrome, which strikes most idealistic white teachers early in their careers (Martin, 2008). They don't realize they're trying to save their students from their "otherness" (whether it be their Blackness, Brownness, or their Nativeness), when in fact they need to look at the problem from the opposite lens, using the proud heritage of the students as their strength. Other fallout is the realization that you can't fix the problems many of your students face, or the problems are so intractable that your feelings of hopelessness and despair quickly set in.

You realize, from your perspective, the students live in danger and again, you want to "save" them but you aren't Superman/Wonder Woman.[7] I was at this juncture early in my teaching career. I had been fairly effective, but trying to "fix" everything was wearing me down. Then I realized and this again, states the purpose of this research, my students didn't need to be "saved" from their Blackness or Brownness. In fact, I had better get on board and embrace the enriching difference we each brought to the classroom. Also, I realized I couldn't "fix" their problems. And the huge relief came when I realized my students didn't expect me to. Nor did they see as many problems as I did. So what do the students want and what can a teacher provide that promotes high-level mathematics learning?

In this study I examined the classroom dynamics through my extensive field notes, recorded conversations with the students about their mathematical experiences, and their writings about their mathematical experiences, their mathematical growth using a pre- and post-test, and an "end of summer" survey to look for clues of Tribal Elder teaching.

Who is the Tribal Elder and what does the Tribal Elder do? I think it goes much deeper than, "coach" or "mentor" or "teacher". What are the characteristics of a Tribal Elder? Lipka (2005), in studies aimed at reforming the schools of the Yu'pik (Native Americans of West Alaska, used the Tribal Elders of the community in conjunction with the teachers to keep the traditions and customs of the Yu'pik culture alive. Notice that there is a combining of the culture—which is held in high regard—with the academics.

[7] I laughed out loud in writing that line, because I realized just as I placed the period, that both my superheroes are white.

Lipka proposes that you can't have one without the other. (One troubling aspect of our schools is that the goal of the school is to systematically replace African American culture with the dominant one.) But a Tribal Elder is one who is a leader in the community, who knows how to navigate the outside world to ensure survival, is related to the students by kin, and the Tribal Elder is trusted by the students and their parents. Well, technically I can't really fit into those structures except for the last one. However, Lipka (2005, pg 7) points out that once you were "respected" as someone who is helping the community to maintain their cultural identity yet improve their lot—you were made a "brother" in that community. This is the way an outsider obtains elder status.

One attribute of a Tribal Elder that may be uncomfortable to teachers is that of using circular lines of authority (tribal) versus top down linear lines of authority (institutional). Institutional lines of authority are exactly what they sound like: Top down and linear. The most important person in the room is the teacher. It leads to a pedagogy of the oppressed, for two reasons—one it is completely the banking system—wherein the students are passive receptacles of knowledge deemed worthy by the dominant culture—and the teacher in our public schools represents the dominant culture over 83% of the time. When this is coupled with a hegemonic curriculum, with a top down delivery system, we have established a system that Hilliard would say that is robbing African American children of their collective consciousness to the community and making them dependent on the culture in power. This disturbs the Tribal Elders in the African American community. They see Black "leaders" who have sold their soul to be a part of the dominant culture—they have done things right—learned the curriculum

that was taught, studied the rules of the game, played by those rules and passed through the "invisible color line" (Hilliard, 1994a).

In a tribal classroom, the relationships are circular. Everyone has equal value in the classroom this is in lockstep with D'Ambrosio's writings on ethnomathematics (D'Ambrosio, 2001a) and with Asa Hilliard's as far as sustaining the African American identity (Hilliard, 1994b). Also, blood-ties are important (Lipka, 2005). So much of teaching boils down to the students' feeling of self-worth. When that is not present, or when the worth of the students is subordinated by curriculum or test scores, it is no wonder we "lose" them. They are worth less to us than a data point in the May, 2011 edition of the "Kansas City Star," which shows the dubious MAP scores. These results were also broadcast on the nightly news the day they were released at 4:30 p.m., 5:00 p.m., 6:00 p.m., and then again at 9:00 p.m. and 10:00 p.m. on four local channels. That's five airings on four channels, so in one day the supposed inferiority of our African American and Latina/o students was blasted out to the public twenty times. In the circular lines of authority in the Tribal Elder classroom, it is the teacher's role to soften this negative impact on her/his marginalized students to restore their dignity and let them know they are valued in society.

Research Questions

Though the research questions in this study are few, the aim of the questions was to assist in opening the "black box" of my teaching style. It was hoped that unpacking my teaching and investigating from the inside would lead to further development of the theory of the mathematics teacher as Tribal Elder in the classroom. The following research questions were investigated in the study:

1. How does a white teacher in an urban classroom become a Tribal Elder teacher?

Questions such as what does that look like? And what is required of the teacher? These are under the umbrella of the first question and are examined in this project? How do you teach?

2. How does a white teacher effectively adapt to the culture of an urban classroom?
3. Can a white teacher effectively adapt to the culture of an urban classroom and teach rigorous mathematics, such as calculus, in a style that's comfortable for the teacher and motivates the students?

All these questions are practitioner centered. Calculus is very abstract and some of its applications to the real world such as in physics, engineering, and economics, and applying these real world applications are quite beyond the scope of a six-week summer session with 9th and 10th grade students. Though calculus may be too abstract to center the instruction around the experiences of the students, a teacher can still center the classroom in terms of opportunities for students to participate in mathematics (Chu & Rubel, 2010). Thus these research questions address what actions are needed by the classroom teacher to foster an environment for these opportunities to take place. The second two questions examine what impact the classroom environment and subject matter has on the mathematical identity and mathematical socialization of the students. Can beginning the study of calculus change a negative mathematical socialization into a positive one?

Theoretical Background

Critical Theory and Paulo Freire

According to the Stanford sociologist on his website, Bohman wrote critical theory "must explain what is wrong with current social reality, identify the actors to change it, and provide both clear norms for criticism and achievable practical goals for social transformation" (Bohman, 2005). Building on this idea, Freire evolved a theory of education for the illiterate people in Brazilian society—the oppressed by the dominant, land owning culture in that society. However, Freire wrote for all societies where *savage inequalities* exist between the "haves" and "have-nots." The have-nots are those on the fringes of society; the marginalized. He based his theory on the conviction that every human being, no matter how "illiterate" or submerged in the "culture of silence" (a *culture* not of the oppressors) is capable of looking at the world critically and in dialogue with others. If we provide the 'oppressed' with the proper tools, they can begin to perceive a personal and social "reality" and deal critically with this knowledge. Navigating the world through a critical lens is what being educated means. It means to make the leap from knowledgeable to wise (Freire, 1970).

An illustrative point of illustrating Paulo Freire's critical theories on education comes from Kincheloe (2004) when he wrote, "I don't trust schools" (p 1). In this statement he is trying to illustrate that "those of us concerned with studying schooling and improving education in this country have to be wary of the goals that schools embrace and the ways they engage particular individuals and groups" (p 1). He continues by writing briefly on the African slave trade during Western Europe's colonization period and the formative years of the United States, and how tens of millions of Africans died

during this time, yet our schools are silent on the subject. According to Kincheloe (2004), any institution that hides from its students the fact that tens of millions of Africans died during the years of the slave trade and African colonization by Europe, is not to be trusted. At least it is not to be trusted by those outside the dominant culture. Plenty is written and taught in the schools of the Holocaust during Hitler's reign of terror. This was a horrible page in history. But our schools are silent on the carnage exacted by the slave trade. Not only is the curriculum silent on people of color, educational research is ensconced in the inferiority paradigms when studying people of color (Martin, 2003). The norm in our U. S. schools is designed for middle-class white males with no regard for differences among groups as social class, gender, cultural orientation, or proficiency in English. These factors are usually ignored (Tate, 1997).

Critical Race Theory

All critical theory looks at power—or who has the hegemony of others and how does that power inform policy. Critical race theorists claim that change happens for two main reasons, 1) there is a true revolution or 2) it is advantageous to the hegemonic group to relinquish some authority and bequeath some ground, but advantageous only because it is to the hegemonic groups' benefit (Tate, 1997). Derrick Bell argued that the only reason that *Brown* passed was because white capitalists needed the Jim Crow system to go away in the South so that they could expand there. The white capitalists feared that: 1) their managers from the North would not want to move to the South with its legalized discrimination and 2) they might also lose their European investors. It was essential, for the good of the white capitalists, that *Brown* win (Bell, 2004).

Leonard (2008) lists what Dixson and Rousseua define as the framework for critical race theory:

1. "Critical race theory recognizes that racism is endemic to American life.
2. Critical race theory expresses skepticism toward dominant legal claims of neutrality, objectivity, colorblindness, and meritocracy.
3. Critical race theory challenges a historicism and insists on a contextual/historical analysis of the law…Critical race theorists…adopt a stance that presumes that racism has contributed to all contemporary manifestations of group advantage and disadvantage.
4. Critical race theory insists on recognition of the experiential knowledge of people of color and our communities of origins in analyzing law and society.
5. Critical race theory is interdisciplinary.
6. Critical race theory works toward the end of eliminating racial oppression as part of a broader goal of ending all forms of racism" (p. 7).

Critical race theory suggests that white European domination is the norm for a society and all laws and social structures to include schools, legitimize this power structure (Leonard, 2008).

Constructivist and Sociocultural Theory

Teaching mathematics should involve "the notion that the very essence of studying mathematics is itself an exercise in exploring, conjecturing, examining, and testing—all aspects of problem solving…Students should be given opportunities to formulate problems from given situations and create new problems" (NCTM, 1991).

Learning through mathematical exploration, is not only consistent with the vision of the NCTM, but also with constructivist and socio-cultural theories on learning mathematics (Cobb, 1994). These theories are built on the cognitive theories of Piaget that contend cognition is a multi-faceted social phenomenon that is not only dependent the mind, but also culturally organized. Cognitive theory supports the view that culture plays an important role in learning mathematics (Cobb, 1994; Saxe, 1991; Secada, 1992). According to the constructivist perspective of learning mathematics, all learners must actively construct their own knowledge through a complex process of accommodation and mutual adaptation. From the constructivist view, the teacher's role is to provide the appropriate environment and activities that induce learners to construct their own knowledge. Complementary to this is the socio-cultural perspective where learning is also a social process in which each individual learns mathematics through cultural interaction (both in and outside of the classroom), meaning negotiation, and shared understanding (Cobb, 1994).

Culturally Relevant Pedagogy

According to Ladson-Billings (1994) the goal of culturally relevant pedagogy is to:

1. Produce students who can achieve academically.
2. Produce students who exhibit cultural consciousness.
3. Develop students who can understand and critique the existing world order.

Students who are part of a minority group must adapt to the norms of the dominant group to have success in that group. They need to gain the "cultural capital" of

that group. Cultural capital embodies the norms, ideologies, language, behavior, mores and practices of a particular group which is transmitted to children as cultural knowledge. Cultural pedagogy uses the cultural capital students of color bring to school as a bridge to help them acquire dominant group norms. Constructivist and socio-cultural theories of learning support the use of culturally relevant pedagogies with students of color (Leonard, 2008). But before we go traipsing off after the latest theories on learning and try to change what goes on in the classroom, we should proceed with caution. Much of the theories of learning are really better described as hypothesis in the layman's, not scientist's meaning of the word.[8] After extensively reviewing several education textbooks, Haberman (2010) found that they espoused six "theories of learning" that included such chestnuts as radical constructivism, information processing, cognitive connectivism, social constructivism, situated cognition, and socialculturalism. He questioned would any practitioner have any idea how to incorporate these theories into the classroom; and in his work he asks effective teachers about these theories and all of them, either claim they don't know what they are exactly, or view them as irrelevant to what they do in the classroom. "The reason is simple; expert advice regarding what future teachers should do is not connected to any theory of learning or to any reality of life in school classrooms" (p. 139).

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[8] Don't misunderstand me on this point. I do sound like an Intelligent Designer with that comment and I am far from that. I do have a positivist epistemological stance when it comes to pure science. The theories of gravity, evolution, special and general relativity, quantum mechanics, have been verified time and time again in the lab. I just don't think we can say the same thing about educational theories and their verification in promoting learning, nor do I think we can find a connection, and lastly, nor do I think it necessary. Teaching involves human interactions, which are messy and unpredictable.

Ethnomathematics

Ethnomathematics is an understanding of mathematical knowing/doing throughout history, within the context of different groups, communities, peoples and nations. To many, ethnomathematics is seen as a "dumbing down" of the mathematical curriculum (Greene, 2000). The premise of ethnomathematicians is not to debunk western mathematics, or to say western mathematics is evil. Rather the premise of ethnomathematics is to recognize the mathematics of other cultures as also having worth. D'Ambrosio is quick to point out that the goal of ethnomathematics is not to replace "good academic mathematics" (p. 28) which "is essential for an individual to be an active being in the modern world." He even admits that in modern society, ethnomathematics will have limited utility. He also wryly points out that much of the mathematics taught in schools today is of little utility to modern man. The goal of ethnomathematics is: "[I]s to bring mathematics to life, dealing with real situations in time and space; and, through criticism, to question the here and now…We are effectively recognizing the importance, in education, of the various cultures and traditions in the formation of a new civilization that is transcultural and transdisciplinary" (p. 34). D'Ambrosio (2001a) claims, "Ethnomathematics is embedded in ethics, focused on the recovery of cultural dignity of the human being" (p. 24). Ethnomathematics enables members of the marginalized fringes of society to perceive themselves as mathematicians. In other words, ethnomathematics validates the mathematics of their culture.

Significance of Study

Doing research on high school age students doing culturally situated mathematics has been difficult (Leonard, 2008). In addition, much of the research on culturally

relevant pedagogy or culturally responsive teaching focuses on attempting to situate the mathematics within the lived experiences of the students or takes a piece of their history and then teaches mathematics through that lens. Very little if any research exists on multicultural teaching and calculus or mathematics that goes beyond first year algebra or rudimentary statistics. This gives the appearance that infusing culturally relevant pedagogy (CRP) and culturally responsive teaching (CRT) into the mathematics classroom is a break from the normal classroom flow. It's as if the classrooms where they have attempted, whether successfully or unsuccessfully to use CRP or CRT, takes time out, does a multicultural lesson, then move on. Another perception is that when culturally responsive teaching is done exclusively, the mathematics is not very rigorous (Gutstein, 2005). Not providing a rigorous mathematics curriculum is in violation of the Equity Principal, which happens to be the first principle listed in the NCTM *Standards* (2000).

The question then, is how does one bundle higher mathematics, equity, and culturally responsive teaching into the classroom? The significance of this study has two facets. One facet is seeing the role of the teacher as that of the Tribal Elder in the classroom. Through in-depth qualitative analysis of field notes, lesson plans, and recordings of interviews, this study attempts to reveal effective strategies that adapt to the culture of the students and also teaches high-level mathematics. The second facet is to still hold fast to the equity and culturally responsive teaching in the classroom mosaic, thus providing the students voice and the opportunity to learn higher mathematics which the literature reveals does not happen (Berry, 2008; Boaler & Greeno, 2000; D'Ambrosio,1999; Davis, & Martin 2008; Gutierrez, 2000; Hilliard, 2003; Hollins et al,

1994; Ladson-Billings, 1997; Martin, & McGee, 2009; Moses & Cobb, 2001). By giving the students opportunity and voice—which in the framework of this study we attempted to create through circular lines of authority rather than institutional "top down" lines of authority—we enable them to perform abstract mathematics at a high level. Giving "voice" also means valuing the culture from which the students come (Hilliard, 1994). The practitioner is thus teaching mathematics through a critical lens. When a teacher values the culture of the students that is very different from his or her own, and when that teacher presents mathematics to promote justice, the practitioner is teaching through the lens of ethnomathematics. Having a record of the success or failure of this type of program for other practitioners to emulate is significant.

The teaching environment I established provided a select group of African American students a rigorous unit of introductory calculus by using the elements of *ethnomathematics*—bringing "mathematics to life" and using mathematics to examine their world critically (D'Ambrosio, 1999). Though considerable work has been done on epistemological models of educational emancipation based on Freire, most of these studies have been done at the junior high level and have used elementary statistics as a way of using mathematics as a critical tool (Frankenstein, 1990; Gutstein, 2005; Gutstein & Peterson, 2006; NCTM, 1997). This study used advanced mathematics—calculus—as D'Ambrosio (2001) writes about "good academic mathematics" which "excludes that which is uninteresting, obsolete and useless" (p. 31). By using calculus it was anticipated this example of rigorous mathematics would bring mathematics to life (D'Ambrosio, 2001a) and per chance provide a transformative experience for the students (Martin, 2009).

Introducing marginalized children to higher mathematics is nothing new. Johnz's Project SEED is an early example. Introduced in California in the early sixties, Johnz's program featured trained mathematicians or scientists leading elementary students in conceptual understandings of advanced mathematics in a Socratic style. The program was very successful and by the late 1980's was adopted in several major cities. Reports and data from these urban school districts show that the project had success. The problem was that it was very expensive. As resources for funding dried up, the project faded (Hollins, Smiler & Spencer, 1994).

This study is an attempt to rejuvenate these types of efforts. As stated before, only 1 in 17 children from poor families who begin college finish. The reasons are varied from financial to academic preparation. Yet, two-thirds of those children who took a course beyond college algebra finished. It is the view of this researcher, that if we bring the beauty of mathematics to African American students entering high school, then they will be motivated to take higher levels mathematics courses.

Definition of Terms

The definition of terms that will be investigated in this study are provided below:

Mathematical identity – a) Ability to perform within a mathematics context, b) the level at which one recognizes the importance of mathematical knowledge, c) constraints and opportunities in mathematical contexts, d) taking a), b), and c) into consideration and the resulting motivation and strategies one uses to pursue their mathematical goals (Cobb, Gesalfi, & Hodge, 2009).

Mathematical socialization – The processes and experiences used by individuals and collective mathematics entities that are shaped by socio-historical, community, school, and intra-personal contexts.

Mathematical literacy – The ability to a) construct mathematical relationships, b) extend and apply mathematical knowledge, c) reflect on and communicate mathematical experiences, d) articulate what one knows, and e) make mathematical knowledge one's own.

Liberatory education – The desired outcome of Freirean pedagogy. Students are liberated in their education when they recognize that they too have value in society, that their knowledge is important to society, and that they now can "read" society critically and can point out oppression and injustice.

Ethnomathematics – The mathematics practiced by certain groups and cultures.

Culturally relevant pedagogy – The use of cultural knowledge, prior experiences, and performance styles of diverse students in an attempt to make learning more appropriate and effective for them. It teaches to and through the strengths of these students (Gay, 2000).

Racialized mathematics – The characterization of mathematics learning as a racialized experience contrasted with the culture-free and situated perspectives of mathematics learning often found in the literature. As a result of their experiences with oppression in this society, the concept of race has historically played a major role in the lives of African Americans.

Racialized contexts – Examining "blackness" not as an excuse, but as a salient attribute of race and racism in school, life, and mathematical experiences.

CHAPTER 2

REVIEW OF LITERATURE

Critical Theory and Paulo Freire

Paulo Freire's landmark and revolutionary work *Pedagogy of the Oppressed* originally published in 1970, forms the cornerstone of this research. As stated earlier, Freire evolved a theory of education for people who are illiterate[1]—the oppressed by a dominant culture in society. This theory is on based the conviction that every human being, no matter how "illiterate" or submerged in the "culture of silence" (a *culture not* of the oppressors) is capable of looking at the world critically and in dialogue with others. If the 'oppressed' have the proper tools, they can begin to perceive a personal and social "reality" and deal critically with their world. Navigating the world through a critical lens means making the leap from having knowledge to being wise. This is the definition of an educated person (Freire, 1970).

In this era of teacher accountability and high stakes testing, the schools, the curriculum, the teachers, and the students are oppressed (Kincheloe, 2001). These entities are oppressed because what the schools, teacher, and students value—relationship building, the discovery of fundamental truths in science, mathematics, history, and the arts, and the preparation of the students to lead productive lives—is not what is valued by outside stake holders and the dominant community. The interests of these institutions is a "snapshot" score on a test. Year after year the urban schools seem to flounder to the point that their troubles have been written off by many as an intractable problem. Urban

[1] "Illiterate" is used as the knowledge and culture of the marginalized people that has no value to those in the dominant culture.

districts continue to spend millions on "cure all" curricular treatments, but real change rarely happens (Barton, 1996; D'Ambrosio, 1999 &2001; Gutierrez, 2000; Gustein, 2003; Hilliard, 2003; Hollins et al, 1994; Ladson-Billings, 1994 & 1995, Lipka et al, 2005; Leonard, 2008; Martin & McGee, 2009; NCTM, 2000; Powell, 2002; Stinson, 2006; Tate, 1997; Tredway, 1999). Some suggest educators need to take the radical view and break away from the prescribed curricula and teach what they believe is necessary. This point of view sees teaching as an overt political act, one that is warranted because educators themselves have been oppressed into a culture of silence due to programmed conformity (Shor, 1987). The National Council for Teachers of Mathematics does encourage mathematics teachers to teach critical thinking and use mathematics as a means, rather than an end to this process (NCTM, 2000). Researchers with a critical theorist or critical race theorist epistemological disposition, claim that most of these critical thinking exercises are arcane problems, where the students have very little background information, led by a teacher espousing the themes of the dominant culture (Frankenstein, 1987, Kincheloe, 2004 & Shor, 1987). Spurred on by the work of Frankenstein, Powell, and D'Ambrosio, some mathematics education researchers have used mathematics in exposing social injustices in their students' lives (Gutstein, 2005 & Tate, 1994).

The most troubling evidence of the dominant culture seeing no worth in the oppressed peoples of the urban core, is in the canned curricula mentioned above that have become so popular in poor, urban school districts (Hilliard, 2004). The teachers are told exactly what to say, and the dutiful students (at least the students remaining who haven't been tossed out for disruptive behavior or gone to private schools) recite back what is

expected (Moses & Cobb, 2001). Complete disdain for the competency of the teachers is also tacitly implied within the framework of these curricula. The years of experience, the relationships established in the classroom that foster learning, wonder, and growth, the inherent knowledge of what their students need, is completely ignored or discredited.

Freire (1970) would call a society using this type of teaching as a society suffering from "narration sickness" (p. 52). The student-teacher relationship involves a *narrating subject* the teacher and "patient" listening *objects* (the students). The teacher (narrator) fills the students (containers). The more the teacher fills, the better the society claims that teacher to be. The more the receptacles allow themselves to be filled, the "better" students they are. Freire would claim this is not the way to educate people and what they are getting out of this education is not knowledge. It is just facts and there is no liberation. Liberation occurs when the students *and* teachers are allowed to think critically by making connections with what is learned to the outside world. A compilation of facts is not knowledge.

"Knowledge emerges only through invention and reinvention, through the restless, impatient, continuing, hopeful inquiry human beings pursue in the world, with the world, and with each other" (p. 54). This is education. Knowledge is gained when there is a true dialogue between students and teachers. True critical thinking of social justice and oppression asks the questions: What has value with the students? What has value with the teacher? This humanizes education and this should be the starting point for all our discussions about "fixing" our education system and holding it accountable.

From the above contexts the NCTM *Standards* calls for the use of problem solving pedagogies (NCTM, 2000). The issue then is that the textbook writers and

teachers, i.e. the dominant culture, select the problems. What Gutstein (2006)proposes is that we have a problem-posing pedagogy where "…people not only shape history but come to understand their power to transcend fatalism and passivity bred by what Friere termed the banking system of education. For Friere, problem-posing education poses to students their life conditions not as immutable but merely as challenges or 'limit situations' upon which people can act and change." Both Gutstein and Friere recognize that such a pedagogy, which challenges the status quo, is seen as dangerous to the dominant culture.

Freirean Ideals in Critical and Culturally Relevant Pedagogy

Robert Moses and the Algebra Project

Robert Moses is a Harvard educated mathematician who was a pioneer in the civil rights movement. During the sixties, he worked tirelessly to ensure the democratic freedom of African Americans in the Deep South by making sure they could vote. He claims this effort from the volunteers to the African Americans living in the South, earned them their democratic freedom, but that the barriers to learning meaningful and rigorous mathematics encountered by African American students is denying them their economic freedom. Moses claims that mathematical knowledge is the key to the future success of all students (Moses and Cobb, 2000).

> As the need for assembly line workers diminished, the need for what economists call the "knowledge worker" grew. Such workers have technical skills related to computers and automated machinery, and interpersonal skills such as the ability to communicate effectively and work as a part of a team. The need for such workers continues to grow along with their salaries…from 1997 to 1999 those in high-tech fields earned 82 percent more than people in other industries (p.8).

Moses was appalled at the 'dumbed-down' mathematics his daughters were receiving in school as opposed to the mathematics being taught in the schools that served predominantly white children. No wonder African American students are not achieving in mathematics, he thought, if this is the kind of education they are receiving. He established the Algebra Project to provide culturally relevant mathematics to marginalized students. He patterned this algebra *movement* after the voter registration drives he led in the Deep South during the sixties.

The pedagogy of the project uses "…a version of experiential learning; it starts with where the children are, experiences they share. We get them to reflect on these drawing from their common culture, then to form abstract conceptualizations out of their reflection and then to apply the reflection back on their experience" (p. 119). This is the very *praxis* of pedagogy espoused by Friere (1970). Those on the margins of culture do have knowledge and it has value. They can also extrapolate that knowledge so that it benefits them and they learn.

The curriculum has a five step process of 1) Physical Events. Taking a trip is the central experience from which the students will construct their knowledge. 2) Pictorial Representation and Modeling. Students move through (including the next three steps) a series of linked and progressively abstracted representations of the physical event. Students are asked to draw pictures of the event based on what the students valued. 3) Intuitive Language—also known as "People Talk." This is where the students put into their own words the physical event they experienced. They are using stories to "write" mathematics in their language. They move from this to 4) Structured Language or in a more formal register, "Feature Talk." At this stage the structure of the mathematics is

examined. An example would be that the students first talk about "going fast" in a car; then "speed" and "rate" would enter their lexicon at this 4th point. Slowly students learn the formal language of mathematics so that they too will become mathematicians. The last stage is 5) Symbolic Representation. Now the students use symbols to represent their ideas.

What is striking about Moses' pedagogy is how it aligns with the NCTM *Process Standards* of problem solving, reasoning and proof, communication, connections and representations. Moses first introduced his pedagogy in 1991 (Moses, 1991) and the *Standards* were published in final form nine years later. In fairness to the NCTM it must be pointed out that they were leading the charge for problem solving reform in the classroom starting in 1980 with their *Agenda for Action* which culminated in 1989 with the publication of the *Curriculum and Evaluation Standards for School Mathematics.* Both documents called for more problem solving, including vexing problems in society, in the mathematics classroom (NCTM, 1991).

Moses' work informs the research project reported in this document in that the mathematics itself (calculus) was above the norm of what is expected for high school freshman. As stated above, Moses was appalled at the low level of mathematics his daughters were receiving in their urban junior high. He saw no reason why they could not learn algebra and that they *should* be learning algebra to compete with the junior high children in suburban schools. By bringing high level mathematics to his daughters' school, Moses was taking on the mantle of what this researcher calls the "Tribal Elder" for the classroom. From the pedagogy described above, the lines of authority in the classroom are circular; the Tribal Elder is "kin" (in this case the father of his daughters in

the class, but also for the other students a recognized and respected member of the community), and he is teaching for "survival" in the competitive, market driven employment sector in our society. Moses' work also provides a standard for liberatory and emancipatory education defined in Chapter One.

Eric Gutstein and *Reading and Writing the World with Mathematics*

Gutstein has combined the emancipatory ideas of Moses and Friere into his *Reading and Writing the World with Mathematics.* His idea is to teach mathematics critically, thus showing that mathematics is not value neutral, but can be used for teaching for social justice. Gutstein worked with low-income Mexican and Mexican American students and families and created a dynamic mathematics classroom where the goal was to teach for social justice. "An important principle of a social justice pedagogy is that students themselves are ultimately a part of the solution to injustice, both as youth and as they grow into adulthood. They need to understand more deeply the conditions of their lives and the sociopolitical dynamics of their world" in order to take on the role of change agent (p. 39). Table 1 illustrates the goals and objectives for the teaching and learning of the students of mathematics from a social justice perspective.

Illuminating the *Social Justice and Pedagogical Goals* is the Freirean concept of "understanding the social-political, cultural-historical conditions of one's life and community." (p. 24).

Table 1.-- Social justice and pedagogical goals of teaching mathematics from a social justice perspective from *Reading and Writing the World with Mathematics. Toward a Pedagogy of Social Justice (p.23.)*

Social Justice Pedagogical Goals	Mathematics Pedagogical Goals
1. Reading the world through mathematics	1. Reading the mathematical word.
2. Writing the world through mathematics	2. Develop mathematical power.
3. Developing positive cultural and social identities	3. Changing one's orientation to mathematics.

The idea of reading the world to Gutstein means

> To use mathematics to understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, gender, language, and other differences…It means to use mathematics to examine these various phenomena both in one's immediate life and in the broader social world and to identify relationships and make connections between them (p. 25).

The idea of reading and writing the world in mathematics is the Freirean notion of *praxis*—the connection of reflection and action. *Writing* the world with mathematics means using mathematics to change the world, because by "writing" you leave your mark and just maybe, you become an agent for change. Gutstein sees this as a "developmental process" as the students start to see how mathematics can help them change the world.

Gutstein recognizes that many minority children believe that mathematics is not something they can do or that is necessary in their lives. He relies heavily, and with good cause, on the research of Ladson-Billings, Moses, and Martin. The last goal of developing positive cultural identities is to change that thinking within the students. His

problem-posing pedagogy sought to build a bridge between the children's Hispanic culture, preserving their rich heritage for which they should be proud, and the world of mathematics where they discover they can excel. Thus, they were learning how to navigate their learning in the dominant culture.

Gutstein uses real world problems relevant to the students' lives such as gentrification and its impact in the barrio, or comparing the cost of one B-2 bomber with the cost of sending his entire class of 35 students to a top tier college for all four years. In my research project, I began by telling the students they would be doing calculus. Some were excited, while others were terrified. Though the students had no idea what calculus really was (even the students who had completed algebra II), they knew it was very high-level mathematics and was a little dark and mysterious. But we started our study on a common ground of algebra which put them at ease. Also in that first session I mentioned that mathematical historians hypothesize that in the destroyed libraries of Alexandria from the Egyptian Dynasties, the rudiments of calculus were found. They learned an African nation, two-thousand years before Newton, had already invented calculus, it's just that the knowledge was destroyed (Sagan, 1979).

One issue that arose in Gutstein's work was the enculturation of formal school that gripped the students and made it difficult for them to openly discuss their findings. He found that the students in the 'normal track' classes needed "spoon feeding" with much of the material, though Gutstein makes clear that this was not because the students were inferior, dumb, or lazy. It was due to the school socialization of a banking system of teaching they had endured their entire academic career. The banking system of education is one that Friere described as suffering from narration sickness (Friere, 1970).

Gutstein (2006) writes, "I now understand better the socialization of students in Rivera's general programs and would therefore more intentionally teach specific competencies, both mathematical and general…I would now try to meet students where they were, instead of where *I*[2] wanted them to be…adjusting my expectations to what I believe are the realities, while challenging students" (p. 163).

In this study I challenge Gutstein's notion on the traditional school socialization of the students being the root cause of what some may see as needy behavior. I do agree that in my experiences with African American students from poor backgrounds in the urban core, they did require, or rather it seemed they "demanded" one-on-one time with the teacher. But as evidenced in my field notes, as the six weeks of my study un-folded, and in my experiences of teaching for years in the urban core, I believe this is the students' way of establishing relationships with their teachers. I propose that they want that one-on-one time to see if you can be trusted. In Gutstein's experimental class, he established that trust right away. The students want to know if you are going to give up something precious like your time to teach them. Eventually, this one-on-one time diminishes and students, once they have established a relationship with you as the teacher, then grow into independent learners. The teacher in "Tribal Elder" mode builds those circular lines of authority by giving time to the students. I point out later in the data analysis of this dissertation that when a teacher "makes sure everyone gets it" before moving on, thus eschewing a timetable for covering the material, that teacher is establishing circular lines of authority. This leads to one role of the Tribal Elder as re-

[2] Italics are my emphasis.

socializing the school into a different kind of school environment that is comfortable to the students.

Critique of Mathematics for Social Justice

Frankenstein (1990) wrote, "Critical mathematical literacy involves the ability to ask basic statistical questions in order to deepen one's appreciation of particular issues. It also involves the ability to present data to change people's perceptions of those issues" (p.338). This is using mathematics in a multicultural context to teach for social justice.

In her article about a community of practice she formed around teaching mathematics for social justice, Gonzalez (2009) attempted to get a cadre of high school teachers working in an urban school in New York City to construct a mathematics unit in a social justice context. The teachers wanted to develop a unit, informed by the work of Gutstein (2006), where the students would "read and write the world" in mathematics, and they wanted the curriculum to be rigorous. This type of unit is grounded in the praxis of Freire, and the effort is laudable. However, there are two glaring oversights on the part of the researcher and the teachers. One oversight is epistemological and the other is mathematical. Both illustrate the difficulty of introducing a curriculum of mathematics for social justice into the classroom.

The epistemological oversight concerns the teachers deciding the topic they want the students to examine. This is anathema to Friere's "problem posing" type curriculum wherein the students decide what they want to learn. By predetermining what is to be studied, the teachers violate the spirit of Freire's epistemology. The question the teachers wanted the kids to answer was: *How well does Urban High School prepare its students for the future?* Though all the teachers believed the students could relate to the topic thus

making the study for the students culturally relevant (Ladson-Billings, 1994; Martin, 2003), it lacked mathematical rigor. In defense though, the teachers were demonstrating to the students that mathematical knowledge and statistics specifically is not neutral (Frankenstein, 1987) thus exposing them to "critical knowledge" and how knowledge impacts their lives and how it is used by those in power. I must admit, in my study I did not *ask* my students what they wanted to learn. I dictated we would learn calculus. However, I did modify the room dynamics to fit an atmosphere in which they felt more comfortable which is described in Chapter Four.

The mathematical oversight had to do with one of the stipulations outlined in the study; it was that the unit must be mathematically "rigorous." Once again, the unit lacked mathematical rigor. As Gonzalez writes, "The most rigorous mathematics part of the unit was aligned with grade nine mathematics standards in NYC, addressing topics such as ratios, percents, and the graphs of tables to display data and probability." It is just this type of unit that gives stake holders and policy makers the opportunity to point out that it is "dumbed down" mathematics. Taking a close look at the mathematical backgrounds of the seven teachers who volunteered for the study, only one had a mathematics degree. The other six had degrees in business, finance, or engineering. Though these disciplines are quantitatively demanding, most of the mathematics is what D'Ambrosio (2001) would describe as utilitarian, thus the participants' profound understanding of subjects such as geometry, algebra, and calculus is suspect. I do not doubt that the teachers had high-level math skills and understood mathematics. What I mean by "profound" is that since most of the teachers came from business and engineering backgrounds, they themselves see mathematics as utilitarian. They see

mathematics not as an end to itself, but as a tool to help them in their work, much as a carpenter sees his or her hammer as an aid to building a deck. The hammer is inconsequential except in knowing how to use it. How it was built, the materials from which it was made, it's grip, its center of mass, the intrinsic atomic and sub-atomic properties of the metal, the beauty of the quantum and electromagnetic world that allows the carpenter to strike the nail and due to the lattice structure of the hammer's head, it doesn't just "pass through" the nail, it moves the nail, through the board. I have found and show in this study that students enjoy mathematics—the hammer—for mathematics' sake. If we focus too much on the utilitarian aspects of mathematics, we rob our students of discovering the beauty of the subject matter.

Forming a community of practice with teachers in like subject areas to develop a meaningful unit for their students, is an excellent idea. It is much better than a "one size fits all" professional development that usually doesn't fit any (Shor, 1987). Though this research project dictates what the students will study, in this case calculus, care has been taken to make the mathematics rigorous and to make the teaching embody culturally responsive pedagogy. Readers will see that very little culturally relevant pedagogy is in the lessons, in fact they were purely mathematical. However, due to the nature of the established classroom environment, culturally responsive teaching took place. This is one of the points of this study, it is not necessary for a White teacher in an urban classroom to go to great lengths to find culturally relevant lessons, but if you establish a classroom on the *Tribal Elder* model, the students learn high-level and important mathematics, the teacher is comfortable in the classroom, and both teacher and the students are liberated for that brief time in the classroom to actually learn.

Ethnomathematics Framed by Culturally Responsive Teaching

Ethnomathematics by Ubiratan D'Ambrosio (2001) is a natural extension of the ground breaking *Pedagogy of the Oppressed* by fellow Brazilian, Paulo Freire, into the realm of mathematics. D'Ambrosio sees the Western European dominance of mathematics as oppressive and that this mathematics is the mathematics of the victors and colonizers. This makes the mathematics of the oppressed culture appear "primitive" or wrong or not useful to those setting the curricular status quo in a society. Thus, D'Ambrosi claims, just by teaching Western mathematics without acknowledging the contributions to the mathematical canon of other cultures, we are oppressing our students. D'Ambrosio sees ethnomathematics as a counterweight to oppressive schooling and policies.

The practical aim of ethnomathematics is to bring an excitement and passion for mathematics to those who in the past have always thought it was obscure and dense. This might get some marginalized students to look deeper into mathematics and to use it to think critically. Thinking critically is the first step to liberation. Thinking critically using mathematics is an invitation into the economic mainstream for many who have been excluded (Moses & Cobb, 2001).

Ethnomathematics is not a dumbed-down curriculum as its critics claim (Greene, 2000). Rather ethnomathematics examines the mathematics embedded in other cultures such as the geometric principles in craftwork, the iterative processes in local architecture, the beat patterns and their meaning in music, or how a certain culture "measures" quantities. Also ethnomathematics encompasses the high-level mathematics used by coastal peoples in their sea navigations, where another example is the navigation across

the Alaskan tundra by that states native peoples. It should be pointed out, that sometimes the translation to Western mathematics is difficult. But in most cases translation is direct and simple. This would be the case with calendars and counting systems. Many times the mathematics is embedded in the culture; Shongo puzzles as Eulerian paths or the mathematical iteration found in the beadwork of Native Americans (Barton, 1996).

Bringing ethnomathematics into the classroom allows the teacher an avenue for studies to engage in critical thought on Western values through the use of mathematics. Students have the opportunity to question if the bravery and "might" of imperialism was always "right." As Powell (2002) writes, "Ethnomathematics represents a break with attributes of Enlightenment thinking. In particular, it departs from a binary mode of thought and a universal conception of mathematical knowledge that privileges European, male, heterosexual, racist, and capitalistic interests and values" (p. 3). Though the teacher may have to go outside the textbook, bringing a touch of ethnomathematics into the urban classroom can show students of color that their culture, the culture of Africa, also performed mathematics at as high a level as the favored Greeks.

Besides issues of social justice and colonialism, high-level mathematics can be taught to high school students using the ancient mathematics of Egypt. Powell (2002) developed a unit where his class used the methods found in the famous Rhind Papyrus (circa. 1650 BCE) to solve up to third order algebraic equations. As Powell claims, this is far from the folklorish and trivializing of African mathematics that is found in so many textbooks. Powell also adds that, "They gain an increased appreciation for the mathematical accomplishments of their ancestors as well as for diverse cultural

manifestations of mathematical ideas…Finally and importantly, students reflect on the politics of knowledge and power." Student can also learn to see through a critical lens, see through mathematics, how the intellectual contributions of the Africans and African Americans are seen as inferior, though the intellectual accomplishments of Europeans has its roots in Africa.

Practitioners must make a concerted effort to distinguish ethnomathematics from multicultural mathematics. Four guiding principles contrast the two: 1) Ethnomathematics infuses deep design themes throughout the curricula. These themes are not trivial or haphazard and reflect important knowledge systems within the culture such as fractal geometry in African design and the presence of four-fold symmetry in Native American art. 2) Ethnomathematics demonstrates that the mathematics found in non-Western cultures is not primitive. "Ethnomathematics directly challenges the epistemological stereotypes most damaging to minority ethnic groups" (Eglash, 2006). 3) In ethnomathematics, translation and not just modeling takes place. This allows students to see clearly that their culture is responsible for deep mathematical structures. This is critical in contesting biological and cultural determinism. And lastly, 4) the culturally situated design tools show dynamic, rather than static views of culture (D' Ambrosio, 1998; Eglash, 2006).

Using these culturally situated design tools and infusing the mathematics curriculum has been effective in schools where it has been applied. By using *real* Tribal Elders and examining the ancient land navigation system of the Yu'pik Indians on the Alaskan Tundra, the standardized test scores of children receiving this curricular treatment improved significantly (Lipka, 2005). When Eglash and his team of

researchers used computer graphic applets to study the mathematics of African hair braiding, they found among other things that ethnomathematics decreases the perceived cultural distance between math and the culture of the students. African American students began to see that math was not something just done to them by the dominant culture. They see it is something African Americans from the past actually did and made significant contributions to the mathematical canon. The second finding is that the mathematics had social relevance. Mathematics was now removed from the abstraction of the stale classroom, to something real in the students' lives. Thus, both findings point towards a new mathematical identity for the students (Eglash, 2006).

In this research project, an introduction of calculus (with the graphing calculator) was taught over a six-week period. How to find a limit, what a limit means, examining functions (which took up more than the total class periods), and lastly investigations into rate of change and taking the first derivative of a function made up the curriculum. Calculus was chosen for several reasons. I have taught calculus before at the college level and really enjoyed it. It is so rewarding, and dare I say *fun* to watch students begin to grasp such an intricate subject. Having this kind of comfort level with the subject, allowed me to think critically about the instruction, the students' reactions, and incorporating culturally relevant elements into the instruction without having to worry about the mathematics or cultural significance of the lesson. Second, calculus has a shroud of mystery around it. The students have heard of it, know it is only for the "smart kids," and yet most of them have no idea what the subject is about. Lastly, there exists a rich background of African American mathematicians and scientists who have advanced the field of calculus and though some of these advances are well beyond the scope of

knowledge of this researcher, the students would discover that their culture has a rich heritage in mathematical achievement. This ties a cultural identity to the mathematics for the students that might strengthen their mathematical identity (Martin, 2000 & Saxe, 1991).

Critical Race Theory and the Achievement Gap

Critical Race Theory

Critical race theory challenges the way educators and education researchers have handled the "race question" because race challenges the thought processes and worldview of the dominant culture. For years, education researchers turned a blind-eye to the issue of race and tried to lump it into gender and class (Martin, 2007). Martin (2007) goes on to explain "these omissions and blind spots suggest the need for theoretical perspectives that move beyond the usual paradigmatic boundaries of educational research to provide a more cogent analysis of 'raced people' and move discussions of race and racism from the margins of scholarly activity to the fore of educational discourse" (p. 196).

Is there a need for the emancipation of African American students, especially African American students in our urban core, from the current pedagogy? Strong arguments are made by policy makers and stake holders that most curricular treatments that have multicultural in the title are simple and lead children away from the test or from learning what is "important" (Ogbu, 2004, Tate, 1997; Stinson, 2006).

Many researchers claim that for policy makers to not value other cultures besides the dominant one is to ignore the history of the African American struggle for education that was denied them—where death was the punishment for learning to read—during slavery, to centuries of degradation as second class citizens, and institutional racism that

is detailed in the histories of our school policies and the racialized scientific inquiry that has supported those policies (Hilliard, 1997 & 1995; Ladson-Billings, 1994, 1997, 2006, 2008; Leonard, 2008, Perry, 2004) . Ignoring history and culture, and failing to view education critically when adopting curriculum, means school programs are not introducing methods of inquiry that make students critical thinkers and thus robs them of the practice they need to be agents of change. This lack of inquiry can then lead to having a most profound effect on the education of our future teachers. A comprehensive approach using a wide lens to examine the issues of African Americans' schooling, in particular, urban African Americans is required (Davis & Martin, 2008, Ladson-Billings, 1997, Perry 2003a, & Tate, 1995).

While teaching math in an urban school, casual conversations among my fellow teachers often times led to the statement, "These kids just don't want to learn." Besides the overt implication of stupidity when claiming someone didn't want to learn—a somewhat heinous act for an educator to make—the implied double meaning was the students were lazy and had a history of this type of behavior to schooling (Ogbu, 1978; Haberman, 2010). Haberman labels such teachers as "lifer/quitters" because they run their classes on autopilot and shirk their responsibilities as teachers and advocates for their students (Haberman, 1994). This assumption seems incorrect because it goes against history. Law and custom made it a crime for enslaved men and women to learn or teach others to read and write. Yet the slave population found ways to learn; either through sympathetic white folks for which the slaves paid large sums of money or traded favors, or in their own clandestine schools. The penalty for getting caught was death. But to learn to read—literacy—was a symbol of freedom and learning was a communal

act. This thirst for knowledge has been passed down through the African American experience in their narrative histories. These stories are well known, though white culture is intent on stamping them out (Perry, 2003b). To be considered "educated" in the African American community meant that you were a leader of your people and that education—your mind—was something "they" couldn't take away from you (Perry, 2003c). The forced apartheid system of slavery persisted for over two hundred years, yet many African Americans found a way to become educated.

Even though the chains of slavery were broken in 1865, this did not lead to any real change in white attitudes towards African Americans as equal citizens. It was still in the constitutions of many states that an African American was counted as only a 3/5's citizen. The right to vote was still in question as well as where one could live, and the schools were segregated. The "separate but equal" status of the schools has been well researched with evidence that overwhelmingly demonstrates that African American children went to inferior schools. In these schools, African American children were taught by unqualified teachers, denied text books, and housed in dilapidated buildings, many of which were condemned by the city (Davis & Martin, 2008; Frankenstein, 1990; Gutierrez, 2000; Ladson-Billings & Tate, IV, 1997; Moses & Cobb, 2001, Perry 2003b; and Secada, 1995). The dominant white culture ensured this second-class education by *Plessy vs. Ferguson,* which legalized the segregation of schools and reinforced, once again to the satisfaction of the white majority, that the African American was inferior to whites. Yet African Americans still learned.

In the African American culture, to be educated meant that you were 'somebody.' In Perry's brief biography of the former Surgeon General of the United States, Joycelyn

Elders, Elders explains that what it meant to be 'somebody' was that "you were human, you were a person, to be counted, to be the opposite of a slave, to be free" (p. 26). Education was not for a vocation, most of the African Americans living around Elders were still driving mules, but they were educated. They were free. Elders goes on to say that this idea of education was not just unique to her family:

> This just wasn't us. It was all the people around us. One reason for this general reverence for learning was that none of the families in Schaal and Tollette and Bright Star was very far removed from slavery. Their great-grandparents, grandparents, sometimes even their parents had been born at a time when they were not allowed to go to school. They weren't permitted to know how to read. They were the immediate descendents of people who had huddled up in undercover schools in churches or hidden out with a teacher in the woods so they could learn letters. So when my father came along, he was going to get as much schooling as he could, even though he was a full-time hand from the time he could lift something or carry something else (p. 27)

Not only did our African American students learn, they excelled. It is this drive for education for freedom, racial uplift, citizenship, and leadership that drives them to excel. As stated earlier, this drive for education is the reason African Americans are so overrepresented as Americas best known intellectuals (Perry, 2003b).[3] As it was back in

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[3] On the surface, this idea may seem perplexing, because a simple ratio argument of whether or not African Americas make up a greater percentage of intellectuals than other groups may not support such a statement. As I read Perry's work, I realize she wants us to go deeper and not just look at the surface. A simple ratio argument would lend credence, and be an appropriate tool of analysis if the opportunities for an "intellectual life" had always been equal. But as I've outlined in this paper, that is far from the case. We also need to expand our definition of "intellectual" to include all the arts and letters, and not just those who hold university professorships. In this expanded definition is where she is taking us.

Starting with Benjamin Banneker, on the mathematics side, who Jefferson called "a very respectable mathematician" all the way to Abdulalim Shabazz—who Clinton awarded the National Mentor Award—African Americans have a rich, well known history of intellectual achievement in mathematics, though they were denied access to mathematics coursework until the early 1900's. Jefferson's quote is high praise indeed from one who also claimed Blacks in reason were "far inferior to whites, as I think one could scarcely be found capable of tracing and comprehending the elements of Euclid." Alex Ross in his award-winning book about modern classical music, *The Rest is Just Noise,* writes eloquently about African Americans wanting to be classical violinists but were turned away at the doors of Juliard and The Curtis Institute. Yet there resolve led to the discovery of jazz and the orchestrations of Count Basie, Duke Ellington, and Cab Calloway. The truly American music—jazz—was brought to us by African Americans. This opened the door for future classically trained musicians such as Marion Anderson, Jesse Norman, and

the era of slavery, to seek out an education was an act of defiance to the status quo. It was also a selfless act for your people. To have knowledge, to obtain an education meant that you were now a leader of your people. It had power. It had power for liberation (Davis & Martin, 2009).

The landmark decision of *Brown vs. Topeka Board of Education*, which set aside *Plessy,* made it appear on the surface that African Americans would be given a truly equal education. It had been slow in coming, and many researchers argue that with the recent policies of No Child Left Behind, the trend has been reversed (Davis & Martin, 2008; Gutstein, 2006; Hilliard, 2003; Kincheloe, 2004; Martin, 2003, Tate, 2004). To deny African Americans their history in our curricular and pedagogical decisions is to deny them their culture and probably the best chances they have of being successful.

Achievement among African Americans in Mathematics

In his ethnographic study of a predominantly African American junior high school in Oakland, California, Martin set out to produce a "straight forward" research study where he would focus on mathematical content, curriculum, and problem-solving behaviors to understand mathematics achievement and persistence issues among African American students (Martin, 2000). Martin believed he was in an ideal situation. The school was implementing the *Algebra Project,* a culturally relevant pedagogical way of

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some may argue even Wynton Marsalis—though in the United States Marion Anderson was not allowed to stay in hotels in many of the cities she performed. Miles Davis wanted badly to be a classical trumpeter, but knew no white orchestra leader would hire him.

Leaving mathematics and music and examining the world of letters African Americans boast a Nobel Prize Laureate in Toni Morrison. Other world renowned writers include Ralph Ellison, James Baldwin, Richard Wright, and Maya Angelou. All of these writers achieved their greatness despite the poor schooling each received. Yet, all these African Americans listed, a very small sample—absent are such notables as W.E.B. Du Bois and George Washington Carver—are very prominent on the intellectual landscape. I believe Perry's hidden point is that it is somewhat miraculous, given the conditions and the racism in this country, that any African American intellectuals exist at all—let alone they are so prominent.

teaching beginning algebra developed by civil rights activist and mathematician Robert Moses. They had qualified teachers of color (except one—who had over twenty years of experience in the school, but the students identified with her well) implementing the program. It was ideal. However, as Martin (2000) puts it, "After a few weeks at Hillside, however, I saw that things were not going as planned. Most troubling to Martin was the large number of students who experienced low motivation and low achievement and engaged in behaviors that had an adverse effect on the teaching and learning of mathematics" (p.3).

Martin wanted to get to the root of the low motivation and the reason many of the students, especially the African-American males seemed to go out of their way to not learn math, though the instruction was excellent and the boys had average to high intelligence. Martin turned to the current research and found very little new except for the "four standards": 1) analyses of achievement tests and pernicious claims of ability based on these so-called unbiased tests; 2) Studies of tracking and differential treatment, 3) studies of student attitudes and course taking patterns, and 4) studies of family background and socioeconomic status. What Martin was witnessing at Hillside was not addressed in these studies. Something deeper was going on. Martin turned his attention away from the mathematics education research and began to look at anthropology, urban education, and the sociology of education where he writes, "Although informative, many of the studies in these areas made it seem that ethnicity, culture, class, and the opportunity were deterministic—ignoring the human agency and individual motivation that can result despite these larger forces…this agency was an especially important component of student's learning" (p.5).

Martin puts previous research and his questions together to examine the effects that history, community, and peers have on the learning of mathematics. In the concluding chapter he develops the idea of "mathematical agency" among the students and their parents, which is their belief about mathematical abilities and motivation to learn. His study consisted of extensive interviews where the participants in his study told their mathematical stories. He discovered important parallels and relationships between his subjects' development of their African American identities and their mathematics identities. A strong identity in one, may mean sacrificing the identity of the other. He found the early mathematics experiences of the adults and community leaders deeply affected the way the children in the community viewed mathematics. Elders in a tight-knit African American community like Oakland hold a lofty, revered place. Many of these elders had bad mathematical experiences in school and so held mathematical ability as not important. This has a devastating trickle down effect. The peer pressure of "acting white" when an African American student showed a proclivity toward mathematics was strong also. However, many students excelled despite these factors and the traditional four factors mentioned earlier. These factors added together is what compromises one's *mathematical socialization*.

For mathematics education researchers, an important idea/hypothesis to come out of this study was that curricular reforms, no matter how well thought out, culturally relevant, and *Standards*-based are doomed to failure unless they get the support of the community. This position is supported in a qualitative study of eight junior high, African American boys. The boys were successfully navigating a first-year high school algebra

course and the two common traits in all the boys were strong parental and community support (Berry, 2008).

Martin's study is important to this research because it investigates the tough cultural issues facing African Americans and their ability to navigate the curricular treatments set up by the dominant culture. In addition, I attempted to move the teacher role from a distant authoritarian construct where the lines of authority are clearly drawn and straight, to a classroom that is more communal, and though I am the authoritarian figure in the room, it is that as an elder to the students.

The achievement gap between African American and white students receives considerable attention from researchers. The purpose of Lubienski's article (2002) was to go beyond looking at the clear disparity between White and Black achievement on the National Assessment of Educational Progress (NAEP), to examine the differences in instructional practices and SES of the two groups. The study provided evidence that, despite current reforms promoting high-quality mathematics education for all (primarily through the NCTM *Standards),* Black students from both low and high SES are being left behind.

This article lends empirical evidence, by examining the massive database of the NAEP, with respect to the qualitative findings of Martin (2000). Something else is going on with our Black students that the old deficit theories and the newer constructivist emphasis on teaching mathematics—which the cognitive researchers claim should be best for the holistic/kinesthetic African American learners—is not working (Cobb, 1994 & Saxe, 1991). Lubienski's results reveal that researchers need to go deeper, as Martin did

and address some of the historical, communal, and sociological factors plaguing many of our African American students.

A most compelling finding was that of the race-SES analyses that indicated the lowest SES White students consistently scored equal to or better than the highest SES Black students across the 4th, 8th, and 10th grades; once again illustrating the need to find the underlying causes of such discrepancies. Martin, however, claims that these types of findings are an example of using race as a categorical variable to meet a positivists' need for "scientific" inquiry. No regard was given for the very real stereotype threat (Steele, 1997) or for racial bias on the test (Martin, 2008; and Tate, 1997).

Lubienski uncovered many discrepancies in the instructional practices some children received based on extensive questionnaires completed by the students. Calculator use was freely encouraged with the White students, whereas it was discouraged with the Black students. Thus adopting the latest technology, or having the opportunity to use it was still denied students of color. An alarming fact was that this occurred with high SES Black students, indicating the "Jim Crow" instructional practices on Black students in suburban schools. Other research has shown that African American students in upper-middle class suburban schools are also tracked in lower classes and denied access to higher algebra and AP Calculus. Not only are these students denied access to higher-level classes, research also shows that remedial classes are normally assigned to the most inexperienced, or least qualified teachers (Ladson-Billings, 1997). Testing practices for Black students were shown to be multiple-choice rather than open-ended reasoning problems, especially in the younger grades. Also, teachers of Black

students were less qualified (lacking 9-12 certification in math for 8th and 12th graders) than for White students (Lubienski, 2000).

The results of this study reveal serious disparities between Black and White students' achievement and access to reform-oriented instruction. Many researchers and teachers claim it is time to get serious about teaching African American children mathematics and it is time to stop looking at the "gaps" that exist and reframe the question (Gutierrez, 2008). New questions to ask are : What are we measuring? Who is hurt? Who is helped by this comparison? And why, as concerned educators do we continue to perpetuate racist myths? However, this position of reframing the question, implies we must look at the explicit racism in our school structure is not wholly accepted by the research community (Lubienski, 2008). The problem these researchers point out is that the way the achievement gap is framed in this country; Black students do poorly while White and Asian students excel, is due to the inferiority of the Black students. That is the perception. The reality, these researchers claim, is the entrenched racism in our school structure, the poor schooling in predominantly Black schools, and the—at times—overt racism of teachers to their Black students creates an "opportunity gap" in mathematics, and has nothing to do with ability (Ladson-Billings, 2008).

Martin (2003) claims when we do nothing but look at the achievement gap, we racially construct a mathematical hierarchy for learning that does three things: 1) Places African American children at the bottom of a mathematical hierarchy and, though it is unjustified, hangs a stigma on these children that they cannot learn mathematics, 2) conceptualizes the mathematics education of African American children contingent upon the well-being of white children, 3) Places the mathematical education of African

American children in the frame that we need to rescue them from their blackness, because it is their blackness which is keeping them down. Also, calls for the "closing of the achievement gap" are really calls for the assimilation of African American children into white dominated culture.

Any talk of reform must address the historical oppression of African American children and the social realities they continue to face. This is defined as their *racialized forms of experience.* These are experiences structured by the relations of race and power that exist in the larger society. Mathematics education should be framed in ways that counter this. Constrained by the dominant culture powerbase, researchers and policymakers still make racist constructions of their findings (Martin, 2008).

Failing districts have spent millions of dollars and hundreds of thousands of professional development man-hours on trying to find that magical curriculum that will reach all of the students. It is hoped this magical curriculum will create happy learners and pleased parents, much to the relief of teachers and administrators. It hasn't happened yet; though publishing companies are more than happy to show you the results of *their* studies that show a marked improvement by students using their products. In the view of the giant publishing houses, failure is the district's fault—not theirs.

The act of recommending a prescriptive curriculum or pedagogy is anathema to critical theory. The classroom is a fluid domain where one pedagogical practice may work for a particular teacher, but could be an abject failure for another teacher. It is my contention also, that the classroom teacher as a true professional, knows what is best for his or her students; not a curriculum writer for a large publishing company (Hilliard, 2004).

W.E.B. Du Bois

Thus far we have reviewed current literature on the achievement gap and efforts to try and bring meaningful mathematics to the urban core. A good place to start when looking to solve, or mitigate a problem that seems so intractable, is to start with looking at the history of race in America. This makes us uncomfortable. The malevolent shark of racism swims freely in the very depths of our society; meacing and always ready to strike. Well-meaning folks from the dominant culture would just as soon ignore that it is there. Some even believe that to claim something or someone is *racist* is a hip joke among the youth of today because racism no longer exists in America (Goldberg, 2011). To those writers such as Goldberg, dwelling on issues of racism is to live in the past and is actually detrimental to African Americans by making them see themselves as hapless victims. Society has changed they claim. Goodness man, we even have a Black president! Civil Rights laws have been passed, and all people of color need to do is adopt the work ethic of the Middle Class[4] because all the barriers have been removed. All you need to do is believe in the American Dream and go for it, and prosperity is yours (Brooks, 2009). To refute such nonsense, one only has to go back in history.

It has been 111 years since *The Souls of Black Folk* was first published and in this seminal book, W. E. B. Du Bois, confronts the harmful racial attitudes toward Black people as being both mentally and biologically inferior to whites. The book was published thirty five years after the end of the Civil War, thirty-seven years after the Emancipation Proclamation and America was still struggling with the "color-line

[4] The term Middle Class values is a buzz word for the White values of the dominant culture.

problem" of what to do with the freed Negro. As cited above and in such books as the *The Bell Curve* (Hartenstein, 1994) and the writings of white society's superiority in the works of D'Souza (D'Souza, 2007), we are still wrestling with the color line problem. In fact these harmful dispositions are so ingrained in the American psyche that well-meaning teachers take them at face value.

The Souls of Black Folk is a rich and poignant book that mixes scholarly writing with music and poetry. The book opens with Du Bois explaining what it means to be Black in America; how it is to be born with a *veil* (Du Bois, 1985).

> After the Egyptian and Indian, the Greek and Roman, the Teuton and Mongolian, the Negro is a sort of seventh son born with a veil, and gifted with a second sight in this American world, a world which yields him no true self-consciousness, but one lets him see himself through the revelation of the other world. It is a peculiar sensation, this, this double-consciousness, this sense of looking at one's self through the eyes of others, of measuring one's soul by the tape of a world that looks on in amused contempt and pity. One ever feels his two-ness, an American Negro; two souls, two thoughts, two un-reconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder. (pg. 3)

The above passage frames the entire text and invokes the Black experience that Whites can never come to know. It is a veil. As a White man, I can look at you and see that you have a veil. I don't know you, you are hidden from me, yet through your veil you can see me and because I am fully visible as well as my thoughts and actions, you do know me and my contempt for you. Yet even with this "gift" of a double sight, Du Bois writes of the struggle of the problem with the "color-line" and questions if freedom will come. Despite this unfulfilled longing for equality, Du Bois' work is still hopeful yet he is ever cautious. It is hopeful that the new Emancipation, where the Negro race is given the freedom to pursue education, training, and a development of a deeper culture that will

not be in conflict with the White race, but rather "in large conformity to the greater ideals of the American Republic, in order that some day on American soil two world-races may each give to one another those characteristics both so sadly lack" (pg. 11). The cautionary tale is as haunting as the one of uplift is hopeful. Du Bois warns that even though the Jim Crow South, which rose up after the Revolution of 1876[5], makes voting seem useless and inconsequential, Du Bois exhorts that they still need to vote otherwise slavery will return.[6]

A striking idea in *Souls* is the type of education Du Bois says is required for the Negro people to rise up and have a culture and to demand an equal place, without qualifications in the American fabric of life. This put him in direct conflict with Booker T. Washington—the darling of the dominant culture media of the day. Du Bois saw Booker T. Washington as the leader of "not of one race, but two: A compromiser between the South, the North, and the Negro" (pg. 49). Du Bois—and other prominent, though aging Negro leaders such as Frederick Douglas—saw Washington's three pillars which was to focus on industrial education, the accumulation of wealth, and the conciliation of the South. Washington asked the Negro peoples of the United States to give up their pursuit of political power, give up on the insistence on civil rights, and give up on the higher education of Negro youth. Mr. Washington wanted the Negro to give up these three ideals and pursue his three pillars. In response to this contrition Du Bois wrote, "Mr. Washington represents in Negro thought the old attitude of adjustment and

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[5] This was the defeat of Reconstruction reforms in Congress which was brought on by a terrible world-wide recession.

[6] In personal conversations with African American students, parents, and friends, they have expressed this fear is not irrational to them.

submission" (pg. 50). Du Bois and Douglas thought that the only avenue to assimilation where the Negro race would experience security and gain respect as co-equals was through self-assertion.

It is not too far a stretch to see that the Washington model is still alive and well in our urban schools and supported by the dominant culture. Vestiges of this system are visible in the dominance of school-to-work programs that flourish in our urban high schools (one could probably include the majority of JROTC programs in urban schools) and the absence of AP courses. This research project was an attempt, in conjunction with vision of the Rise Up program, to rekindle the efforts of Du Bois to bring about assimilation through self-assertion and to begin that journey by tackling some challenging mathematics.

Du Bois follows up on this theme of a deep, cultural education that challenges the status quo and teaches for uplift in his essay, The Immortal Child, from a collection of essays in the book *Dark Water, Voices from within the Veil (*Du Bois, 2003). Du Bois begins this essay reviewing the short, yet full and meteoric life of the Black classical composer Samuel Coleridge-Taylor who died in 1910. Originally from Deonica Leone, Coleridge-Taylor was a professor of music composition at Cambridge University in England. His greatest composition, *The Wedding Feast of Hiawatha,* was as popular in its day in choral music circles as Handel's Messiah. Coleridge-Taylor did make it to the United States to work with other composers, Black and White, and was heralded by the US White press as the "African Mahler" (Stuart & Duran, 1999).

Du Bois celebrates Colridge-Taylor's genius as the type of genius that needs to be nurtured in the Negro child. He painfully wonders how many genius boys' and girls'

voices, gifts, and talents that are silenced by the segregationist institutions of learning in the United States. Du Bois takes the radical view that the failure of our educational system for the Negro is due to the fact that the educational aim is not for the full development of the child, but that education is designed to maintain the status quo (p. 208). He argues that when the aim of education is to prepare a person for the factory and not to reason, then this is the reason for strife, war, and revolution. As long as the system can make workers content with their present condition, and not learn to question why things are the way they are, then Jim Crow will live on with the tacit approval from all who benefit from the current state of affairs. Du Bois then lays out what the goal of an education should be:

> Let us return to fundamental ideals. Children must be trained in what the world is what it knows and how it does its daily work. These things cannot be separated: We cannot teach pure knowledge from actual facts, or separate truth from the human mind. Above all we must not forget what the object of all education is the child itself and not what it does or makes (p. 212).

The above paragraph provides a clear juxtaposition to what appears to some as the goal of education today, and that is our children need to be trained to compete in our vicious economic world. This is the explicit goal of the Obama Administration's education policy which is aptly titled, *Race to the Top* (Karp, 2010). Du Bois' words resonate in concert with many of our critical race theorists. These theorists such as Du Bois and later Martin challenge us to examine how and why we are educating our African American children; what is our motivation for educating our African American children and for whose gain are we doing it (Martin, 2008)? Teaching to the test, benchmarks, and canned curricula do not allow time, nor is it encouraged, to teach students to think critically.

In my classroom this summer, my students told me what I thought were horror stories of the benchmark system of the mathematics curriculum. The goal of the Benchmark curriculum is to pass the benchmark—nothing else matters. The grade of the student (and the implicit "grade" of the teacher) boils down to how well and how fast students progress through the benchmarks. Homework is not necessary and "drill-and-kill" defines the classroom time. My students told me that they didn't need to do their homework, or there wasn't any need to practice, because once you "memorized" the answer for the benchmark test and then passed that test, you moved on. I asked if they learned the material, "not really" was the typical response. But at this juncture, many of the Rise Up students (and one rebellious junior high math teacher I was told about) showed their resilience, and the teacher showed her defiance to an educational system that was working against them. Many of my Rise Up students asked their teachers for extra work and took it home and did homework for practice. This rebellious teacher mentioned earlier, made the benchmarks, only worth a small percentage of their grade. This policy, which actually promoted learning (product) over benchmarks (process), went against the school's policy. Her students were rising freshmen in my summer class, but they had the confidence to do calculus and the worldliness to question the status quo of the benchmark system. These determined scholars and courageous teacher—acting in the role of what Lipka would call a true Tribal Elder (Lipka, 2004)—refused to "separate truth from the mind" and taught the whole child and the whole child became educated.

If one is to teach African American students, then one should understand their history. This history is not taught in our public schools, in fact history books defer to history told from the side of the dominant culture (Hilliard, 1997). It is important for the

teacher of African American children to study Du Bois and his writings so that the teacher of these children understands who they are. You can't be their Tribal Elder and be looked upon as "kin" unless you share their history. A white teacher does share this history; my history is shared from the other side of the veil. But understanding the collective history of your students and how it intersects with yours, and then motivating the students to learn, leads one to Elder status.

Asa Hilliard

In the book *SBA: The Reawakening of the African Mind (*1997) which is a collection of provocative essays by the African American historian, psychologist, and educator Asa Hilliard, the author, opens with the claim that African people are in the midst of a crisis. He speaks of all African peoples, from the Americas, to the Caribbean, to Europe, and Africa itself. He refers to this crisis as a MAAFA, which is a Kiswahilli term that means "disaster." The term also "refers to the terroristic interruption of African civilization that was occasioned by European and Arab and cultural aggression" (p. 1). Just with this opening sentence, the tone is set for these essays. This is not playing nice with having multiculturalism introduced in the classroom or to simply raise awareness of the conditions of African Americans in the urban core. That ground has been trod before, and some Black leaders see that path leading to nowhere. Rather this book is a call to the African peoples to reclaim their history, their culture, and with that their self esteem. These essays echo Du Bois' call for full assimilation into the American mainstream on the African peoples' own terms.

Hilliard sees the struggle as much more than for equal rights, he sees the reclaiming of African culture and for people to embrace their *African-ness* as a matter of life and death. He writes that:

> The MAFAA continues to take its toll. We are unconscious, unorganized, unfocused, and lost from our purpose. Our strongest visible leadership is in hot pursuit of minimal, narrow goals like, "integration," "civil rights," "jobs," "voter registration," etc. We seek minimal adjustment and temporary comfort by assimilating to whatever the political, economic, and cultural order may be, even where that order itself is in a state of chaos, or driven by values that are anti-African and anti-human. When we "dream" we often do not dream original dreams; merely we seek relief from pain. As a result, the dream does not encompass a meaningful plan or strategy which is connected to mobilization. (p. 5)

Hilliard makes the point that White policy makers either from the left or right, both political parties, and liberal or conservative view the very existence of African Americans as a problem. Thus it is up to Africans to make sure they are fully able to have a quality of life on their own terms. This is where he introduces the idea of SBA. SBA comes from the language of ancient Egypt (or KMT[7]) and means teaching, learning, wisdom, and study, or collectively, deep thought. When a people do this as a society and culture, this will lead to another KMT term, SIA, which means "insight." This is an important point for this research project on classroom practices that move the teacher to Tribal Elder, because to teach as the Tribal Elder to your students who have had a long history of oppression and school failure, you must teach for insight. I was not teaching for a critical insight from my students, but I wanted to have the deep personal insight that

[7] Hilliard uses many African words in his writings and capitalizes them, since these words don't translate well into our alphabet. Many come from hieroglyphics and the consonants are left out. Much like the use of YHWH in the Hebrew Bible to name one aspect of God.

mathematics was intrinsic in their culture and that the discipline of studying mathematics, just for the joy of learning, brings uplift.

I also tried to have my teacher role subsumed into the Tribal Elder role, because Hilliard describes the traditional African pedagogy as one of socialization—the education had to have a purpose in their lives. This does not mean so much cultural relevance, rather it goes much deeper in that the educational experience must have a functional relationship with the surrounding society which leads to the "transformation of the student" (pg. 10). Consequently, the content of African education was always the cultural wealth of the African family. Hilliard compares this goal with that of Western education where he writes, "the aims of education tend to not include socialization, except in a minimal or negative way. The goals of most educational systems in Western culture are temporal, earthbound, and essentially materialistic. This is because greed and materialism are the dominant cultural values" (pg. 10).

The culture of greed and materialism and how that manifests itself in our urban classrooms is evident in the curricula adopted, the attitudes of teachers, and the high stakes testing environment. But I noticed my Rise Up students fought this culture, though how conscious they were of their defiant actions I'm not certain. How this manifested itself and how they expressed the actions certain teachers took in the classroom to make it less *Western* is discussed more in Chapters 4 and 5. Taking my cue from Hilliard's writings, as Tribal Elder teacher I made an attempt to focus my pedagogy on the full transformation of the student. The goal of an education, in the spirit of Hilliard, is not to just teach skills to sustain life, but rather to give a purpose to life.

Hilliard began his essay *40 Years after Brown: Now What* with the reason for segregation of schools. He writes:

> Segregation was an active attempt to teach that Africans were mentally, spiritually, socially, and morally inferior. The goal was to get Africans to be docile and accept domination and to provide free labor without complaint. This required that all institutional processes within the system, especially the schools, be used not only to provide a separate education, but one which helped to manufacture the myth of an inferior African who could be juxtaposed to the myth of the superior European. (p. 51)

Thus *Brown* attempted to right the wrong problem. Desegregation dealt with the physical separation of Whites and African Americans. The issue was not physical but ideological. To illustrate his point further, Hilliard points out the predictions made by an aging Du Bois in 1960, four years after the historic case passed. Hilliard agreed with his post-*Brown* assessment on the future education of African Americans:

> [Du Bois'] key predictions were that 1) there would be fewer African teachers, 2) African children would be taught in a physically and emotionally uncomfortable environment, 3) there would be an increase in the African student drop out rates and a decrease in Black college attendance, 4) African universities would disappear, and 5) African history would be taught rarely, if at all. (p. 57)

Though Hilliard acknowledged the *Brown* proponents were well meaning, he noted that many unfortunate consequences have emerged. He writes:

> Affluent blacks have abandoned black communities; affluent whites have moved away from traditional communities taking businesses and tax revenues with them; there are fewer Black teachers and principals; many premier secondary schools in Black communities have closed, there is an increase in special education categories; increased use of invalid psychological examinations; increased "discipline" problems; historically Black colleges and universities are threatened; expanded tracking; more attacks on and acceptance of white supremacist propaganda regarding African intelligence; more racist curricula; increased funding inequities; more teachers are disconnected from students; and there are more faulty educational research hypotheses. (p. 64)

What does Hilliard recommend as a solution, or at least a start to a solution? Hilliard believes that African Americans need to reclaim their African identity and culture. Like Friere, Hilliard believes that the reform movements as practiced by the dominant culture will be more oppressive than liberatory which happens when politics, not humanity drives reform and that reform must come from within the oppressed culture itself.

In his book, *The Maroon Within Us* (Hilliard, 1997), Hilliard describes the *Maroon* as several groups of freed or escaped slaves who lived outside of the white dominated areas of the deep South and the Caribbean.[8] These collective groups lived and thrived by keeping the culture and society that they brought with them from Africa. They taught their children their ways and held fast to these ways to the point of death. Because they knew the first thing that an oppressive regime does to a subjugated people, is to rip their culture away from them. By ripping away their culture generation, after generation, you destroy a people's memory and with that, their ability to resist. Hilliard claims this is what has happened to the African Americans in this country. Like Du Bois, Hilliard's desire was to have the Black folks (Du Bois' words) join American society not by assimilating from a position of weakness—meaning accepting the terms of the oppression, but to join American society as cultural equals. Thus Hilliard makes an appeal in this book for African Americans to reclaim their rich, intellectual past and pass

[8] I believe myself to be a fairly informed person and quite knowledgeable—for a privileged "white guy" on issues of African American culture and history. Until the summer of 2011—after almost 45 years of constant schooling, I had never heard of the Maroon. I find this quite telling of the hegemonic nature of our American educational system.

that along to their children. Hilliard believes that only through the reclaiming of culture, can you rise as an equal.

Part of this reclaiming begins with the pedagogy of the KEMET, or those of ancient Egypt which Hilliard lays out as the cradle of human thought. He takes pains to present the convincing argument that shows how the Greeks, Romans, and then Western Europe embraced these African teachings and how in conquest they claimed them as their own and ripped the culture away from the conquered. The goals of the KEMT pedagogy were 1) unity of the person, unity of the tribe, and unity with nature; 2) the development of social responsibility; 3) the development of character; the development of spiritual power (p. 97). Hilliard points out that the method used was more of a collective effort than an individual one. When I read this I immediately thought of my Rise Up students talking about effective teachers and saying how "they made sure everybody got it before moving on."

In the chapter "Saving the Children," Hilliard talks about how the institutions of education in this country view reports on "excellence" in schools as really more of a report on *efficiency* in meeting "standards" and these standards are for technical proficiency and do not meet the needs of African American children.

> What I am saying is that most of the definitions of 'excellence' are not excellent' they are deficient. They are largely devoid of African Americans' special problems and to African American content. Under these popular definitions, an African American student could be "excellent" and not know where Africa is, what nations are there, who the leaders are, what the problems are, and how the problems relate to him or her. It is this cultural retardation in Africa American history and culture that leaves our children unable to tell the difference between *excellent technical talent* and *excellent role models.* (p.111)

Hilliard then explains African systems of education which include 1) the separation of the child from daily life and this has deep meaning and reverence; 2) education is centered around the observation of nature where Nature itself is regarded as teacher; 3) the instruction through peers and that all children are expected to master things together; 4) children are expected to show they have put away immature things in a kind of rejection of childhood and an acceptance of the responsibilities of manhood and womanhood; 5) and listening to elders. Elders play a large role in the education and socialization of African children (p. 137).

The above attributes of education can be used in our schools today Hilliard argues. The pedagogical practices of the teacher are then centered around the teachers who focus their teaching and curricula towards the children's needs, a respect for everyone in the classroom, the learning of responsibility, feedback is mature and well-intentioned, each child is recognized for his/her contribution to the group, and lastly love. Hilliard writes, "We must provide an environment for all our children where they experience love as they struggle to become the adults that we want them to be" (p. 138).

The above two paragraphs provide another lens for the vision I had for teaching as a Tribal Elder in my classroom. Reflecting back on my teaching, I believe intuitively I did this type of teaching, but until I read Hilliard's book, I couldn't really name what I was doing that seemed effective. This leads us to look at the style of teaching that I pattern to fit my students' varied styles of learning.

Hilliard cautions us on spending too much time figuring out the best teaching style to fit a certain learning style. There is no scientific evidence that reveals a biological connection to learning styles of humans, or rather that a child favors being an

auditory learner, or visual learner (Stix, 2011). Learning styles are learned through our cultural interactions as we grow and mature. Hilliard defines a learning style as simply "a predisposition to approach things in a characteristic way" (Hilliard, 1997; p. 171). A troubling question then arises of whether or not it's the hegemonic, Western European disposition of our schools that is stunting the learning of our marginalized students. So, should a teacher adopt a learning style to fit the students? According to Hilliard this misses the point. It is the "systemic inequities" in our schools that are causing the children to fail (Hilliard, 1997; p. 173).

In fact, labeling a group with a certain style can lead educators to believe certain styles lack the potential to learn complex subject matter. We must be on guard that, "If stylistic differences are interpreted as evidence of capacity rather than as an expression of preference, a long chain of Asaadses is set in motion" (p. 175). Some of these Asaadses include misreading achievement such as creative expression, and language abilities. The research cited thus far, indicates that many researchers and White society in general see African Americans as incapable of learning mathematics and that African Americans do not care for mathematics. In actuality, it's not that African Americans don't care for or are incapable of doing a high level of mathematics, it has just been that their socialization of mathematics has turned them off the subject.

Pedagogical Frameworks

The question then for practitioners is what pedagogical practices are effective? Or maybe a better question might be how can we tap into the collective genius of our students, their culture, and their long history, to inspire them to learn high-level mathematics? The inspiration for this research project came from Hilliard's writings on

Professor Abdulalim Shabazz and I believe that gives us a good place to start with the framework of the pedagogical practices in my Rise Up classroom.

Abdulalim Shabazz is an African American mathematician who received his doctorate in mathematics from Cornell University in 1955 and has worked as both an educator and research mathematician. His most noted work in mathematics education occurred during his two tenures as Chair of the mathematics department at the historically black college of Clark University in Atlanta. He is noted for demanding excellence and hard work of his students, and instilling in them a belief that they could do the mathematics. His controversial moves as chair were to eliminate the remedial courses and begin students at the college algebra level or higher, regardless of placement, SAT, or ACT scores which Shabazz saw as useless in evaluating the potential of his students. When professors complained, he countered they were afraid to do the hard work of bringing students, who through no fault of their own had gaping holes in their mathematics education, quickly up to standard.

When he arrived at Clark, Students were failing in great numbers even the remedial courses. Because of the concern for remediation prior to his chairmanship, no one received a B.S. or B.A. in mathematics in 1990, and only one master's degree was awarded that year. During the five years Shabazz was chair of the Department of Mathematical Sciences, 77 B.S. or B.A. degrees and 45 master's degrees were awarded. The high point was 1995 when 23 bachelor's and 23 master's degrees were awarded. This was during his second term at Clark. During his first tenure between 1956 and 1963 he saw 109 African American students graduate with masters degrees in mathematics, a

third of these went on to receive PhD's in mathematics. Shabazz's slogan was, "Give me your worst ones and I will teach them!" (p. 195)

Shabazz focused on goals of excellence that informed the goals for my Rise Up course. They are:

> 1. To teach understanding rather than merely to teach mathematical operations.
>
> 2. To teach mathematical language for the purpose of communicating in mathematics and not merely as a way to solve textbook problems.
>
> 3. To teach that math was not at all a fixed body of knowledge, but that it was an experimental enterprise in the truest sense of the word "experiment" and that their approach to the solution of mathematical problems then and in the future, should be to try a variety of strategies;
>
> 4. To have students believe, as he did, that mathematics, "is nothing more than a reflection of life and that life itself is mathematical." He wanted them to know that the symbols used in mathematics approximate the reality of human experience and cosmic operations.
>
> 5. To give students a sense of hope that they could become superior performers. (p. 197)

Points 4 and 5 are in the purview of Tribal Elder teaching. Shabazz lamented the fact that society in general has internalized the false paradigm of teaching, especially in

mathematics, that only a select few will ever understand the intricacies of such an abstract field of study, and hardly any, African Americans, Latino/a, or Native American students will ever be in that august group. An underlying theme of my research project was to hold this myth up to my students, and show them that they had the power to either give up and prove it true, or work hard, thus smashing one more racist myth.

Since my premise is to immerse myself into the classroom as a Tribal Elder and allow the cultural norms of my students to dictate the norms of the classroom, one could say this is an Afrocentric pedagogy. According to Kifano (1997) this pedagogy contains (1) a definition and interpretation of reality from an Afrocentric perspective; (2) an emphasis on the acquisition of primary and higher-order thinking skills of critical, analytical, and creative thought; (3) the promotion of a strong desire among African American youth to serve their people and communities; (4) the emphasis on value orientation and the development of a positive and proactive concept of the self, society, and the world; and (5) the inculcation of a respect for human diversity. These five attributes were important to this research because they did provide a simple, yet deeply robust framework for the classroom.

The problem becomes then, how does a white teacher, become a Tribal Elder in a classroom of African American students? This becomes a question of race and the White teacher fighting his or her cultural norms (world view) where racist attitudes are so engrained. The white teacher may not be aware he or she is acting in a racist way. Research indicates these students have been victims of racist teachers (Ladson Billings, 2008). The kind of racism students face from teachers is tied to Wellman's (1977) definition of racism as "culturally sanctioned beliefs which regardless of the intentions

involved, defend the advantages whites have because of the subordinated positions of racial minorities." Because I was a white teacher in a classroom of African Americans, it is important to review some of the literature on that dynamic, beginning with where we are regarding racism in this country.

Changing the dynamic has been an ongoing struggle and many wish, or even believe, that the struggle is now over and we should move on. The claim "you're racist" has almost taken on a badge of honor with conservative white pundits as they try and press the agenda that racism is over and that by uttering the phrase, "you're racist" the speaker is lamely behind the times. In fact, these pundits claim that society is not racist anymore, and just because I might abhor Barrack Obama as president and every policy issue he stands for, I am not a racist and the young hipsters of all colors would claim the joke is on you if you're still holding to old beliefs that are now dead (Goldberg, 2011). Or we applaud the success of kids who have achieved "success" based on a white model world view definition of "success", because these kids adopted the norms of white-middle class society (Brooks, 2009). Applauding their transformation to finally seeing the light that the White way is the right way does not make me a racist. In fact, they turn the tables on those who point out that by the very nature of their claims that the "white way" is the "right way" as a hegemonic stance of white supremacy, they cry reverse discrimination. This attitude not only bleeds into the way schools are run and the policies and how they set policy, but the White way is the right way attitude heinously seeps into the decision making of African American leaders.

In Ladson-Billings' article *Preparing Teachers for Diverse Student Populations: A Critical Race Theory Prospective* (1999), where the author is examining how to

prepare the predominantly white teachers to go into urban schools and teach. The article views teacher preparation through the lens of critical race theory which is based on the premise that most civil rights legislation continues to serve white interests.

After a brief, but thorough discussion of critical race theory, Ladson-Billings mentions the 1983 Commission on Excellence in Education report called *A Nation at Risk*. This report and its ramifications based on suspect research, or lack there of, is addressed elsewhere in this study, but Ladson-Billings introduces a subtle point at what happened after that report came out. She writes, "[Within a short time, the at-risk label went from describing the nation to describing certain children. Being at-risk became synonymous with being a "person of color" (p. 218). She wondered how this could happen, but then quickly points out how this is "emblematic of the way the language of difference (disadvantage, diversity) works to construct a position of inferiority even when that may not have been the original intent" (p. 219).

Setting this premise she begins a wry critical race "story" of how the dominant white community views public schools forty-five years at the time the article was written after *Brown vs. Board*. There is this wistful almost *Lake Woebegone* like remembrance of a time that never really existed but is so burnished into the minds of white middle-class Americans that, as Ladson-Billings states, they pine for the Public Schools of Way Back When (PSWBW). But what disrupted this "Eden" of public schools? Why it was the "nine wise men" deciding to desegregate the schools. The public reaction to that decision has been a mixed bag of some hailing the decision as one of the greatest pieces of legislation passed since the GI-Bill, while others have pointed out the harm it caused to our African American children (Hilliard, 1995). W. E. B. DuBois made several dire

predictions in 1960 most of which have come true in certain respects (i.e., the loss of African American teachers and the de-socialization of schooling for Black children) as discussed earlier.

But the purpose of this article was to examine, not the public reaction, but how do we train our teachers and how that was affected by the dominant society's reaction to *Brown*? What has that looked like?

After *Brown vs. Board* many teachers, who had been promised to teach in schools that purported the PSWBW myth, began to lament, "I didn't sign up for this" when they landed their first teacher job in an urban school. Schools of education "knew that any real attention to the educational needs of all students would expose the mythology of PSWBW; everyone would see that it was not an objective reality but a social rubric to justify particular schooling practices. Really paying attention to the problem would mean that teachers would learn that most teacher education programs had not helped them teach any students. Thus we could not have a complete revamping of the school of education pipeline. All that was needed was to add a hodgepodge of "multicultural" classes and send the teachers on their way. Even though as late as 1990 (35 years after *Brown vs. Board)* no empirical studies were ever done to determine the effectiveness of this multicultural approach.

Ladson-Billings then looks at the current models for prospective teacher selection that exist in our schools of education. These models developed by schools of education that fit the multicultural criteria to make sure that teachers have a "rigorous" education, actually keep students of color from entering education. Not because intellectually they are incapable, but rather, as we have seen before, the socialization of the standardized test

requirements keeps them away from teaching programs. Thus we have teacher education programs that are full of prospective candidates who have no desire to teach in urban schools. White middle-class teachers thus wind up in urban classrooms and claim they "are not prepared to teach *these* children" (p. 224). She claims that *these children* fit nicely into the discourse of PSWBW when we didn't have the "problem" of these children back then.

The research described here is grounded in action research and self-inquiry methods. Justification for this type of research can be found in Cochran-Smith (2005) who suggest that teachers actually produce the best evidence of practice that is effective. Cochran-Smith calls it unpacking the "black box" of teaching. Can studying effective teachers lead to getting qualified teachers in the classroom and then more importantly how do we guide them so that they are effective teachers in our urban core? Practitioner research appears to say yes. However, nationwide this is not how we are teaching future teachers, thus we are falling short in filing our teacher needs in the urban core (Cochran-Smith, 1999 & 2005; Haberman, 1997 & 2010).

One approach for meeting this pressing need for highly-qualified teachers dominating the literature is the market driven approach, which envisions a society where the greater good is reached by everyone pursuing their own self interests. Freedom is in the market and the freedom to choose. What the framers of this policy want is to expose schools of education to market pressures—removing draconian certification requirements as an example—so that schools have a "choice" in the teachers they hire. In this way, plum teaching jobs become even more competitive and wealthy districts will still hire certified teachers. The thinking is that by removing barriers to the classroom,

professionals with outside experiences will come into teaching. The Teaching Commission extols the use of the market system yet even admitted in their reports that the affluent districts would not be effected by such a policy change, but that it would have an impact on the rural and urban districts, ironically, in a negative way (Cochran-Smith, 2005).

So the question becomes, does a market-driven approach help poor communities? Based on the soaring income gaps between whites and people of color during these past few decades, the de-regulation of the banking industry which led to the sub-prime mortgage fiasco caused by lenders targeting the under-represented with loans the industry knew they couldn't afford, but the short term gain of the "default swap" lined the pockets of the rich with "free money" and we know the end of the story. Market driven policies means you have society competing for precious resources. Is this the best way to save our schools, or improve the education of our children in the urban core? Cochran-Smith contrasts this to a model of political community where individuals live in a web of dependencies, loyalties, and associations and they envision a fight for the public interest as well as the individual interest.

The Obama Administration leans heavily toward the market approach to fixing schools. Arne Duncan's "Race to the Top" rewards a handful of struggling districts with money because they have been innovative in developing some intervention (whether or not it is successful is beside the point; it just has to be different and innovative), while other struggling districts are punished, by getting nothing (Karp, 2010).

The logical consequence of the market-based model in any enterprise is that eventually there would be an end to poverty. The assumption is that if I get richer, than

eventually I will pull you up too. John F. Kennedy used the phrase "a rising tide lifts all boats" to explain why government largesse in one area, helps the citizens in another. In the past fifty years it has been co-opted by the fiscal conservatives to defer taxes on the wealthy, so that they can give back to the economy. Most economists agree that thirty years of "trickle down" economics of this sort has not worked (Krugman, 2009). The champions of the market-based model to improve teaching by giving communities more choice, even claim in their research that wealthy communities will not be effected by such a policy switch. They will still attract teachers who are credentialed. It could however, they write, exacerbate the situation in our urban core (Cochran-Smith, 2005, pg7).

In summary, Cochran-Smith explores ways that teacher knowledge can serve as a catalyst for different forms of research and practice. She attempts to help prospective teachers develop perspectives that enable them to cope with race and language diversity. This allows teachers to build their own theory and practice on teaching from the ground up (Ladson-Billings, 1999). This provides an affective avenue for young, white, middle-class teachers to explore prepare for the urban core. They have an opportunity to practice in the urban core, tell their "story" and reflect on the day-to-day actions taken in the classroom. This might lead to a transformative experience that might get them to stay in the urban core and become agents of change themselves in the schooling of our marginalized students. Thus we can create a two-pronged strategy that meets both the needs of the teachers and they become affective teachers so they meet the needs of their students.

Teacher Preparation and Practice for the Urban Classroom

Since I examined my practice in the classroom in this action research project, a review of some of the literature on effective practice and teacher education was warranted. This provides a basis for comparison and critique which can cut both ways. What I mean is, my teaching or background may not fit the ideals espoused by research, but it does give other practitioners a place to compare and contrast their teaching of mathematics in the urban classroom.

Haberman (1995) a long-time advocate for children in poverty stricken schools and Emeritus professor of education at the University of Wisconsin-Milwaukee, provides the assumption that all teachers of youth in poverty must have is that they are teaching for the very lives of these children. The very survival of these children depends on how well the school equips them to handle the challenges in their lives. Because of this responsibility (and it is the role of a Tribal Elder to ensure the survival of the elder's "people") Haberman characterizes the day-to-day work of a teacher in an urban environment as being one of immense intensity. He writes, "Great pressure is felt by practitioners who are aware and feel accountable for the very lives of their clients." He frames the context and baseline knowledge of the teacher educator of these children as being those who can function with a cool head when chaos reigns around them. This is a strange place for most teachers new to this environment, when this experience is so alien to what they knew as students in suburbia. For them, teaching has never been a life or death situation.

So where does a pre-service teacher get this knowledge? Haberman argues the sources of knowledge are not found in the coursework of most schools of education, but

rather come from the experiences of effective veteran teachers in the urban core. Top on the list, thus most important to Haberman, is experiential knowledge. What works in the urban classroom is derived from the experience of affective teachers who have excelled in this chaotic environment. Second are the "best practices" which depend on the context in which the teaching is taking place. Research and theory take a backseat to common sense. And those educators with the most potential are those with the most useful knowledge for new teachers: effective classroom teachers currently implementing those practices in poverty stricken schools.

Haberman also argues that schools of education are not preparing teachers for the urban core and that this system will continue until schools of education are held accountable for the teachers they produce. The mind numbing bureaucracies that exist in urban districts exacerbate the problem where the processes of education have a much higher importance with these staffs than product. Thus the districts wear down those teachers who are trying to make a change and all that is left is a "lifer/quitter" (Habermon, 2010).

A "lifer/quitter" Haberman describes as the insensitive teacher who is not worn down by the bureaucracy of the system that destroys children's lives. The "lifer" has an educational ideology of one who 1) makes no effort to meet the needs of his or her students; 2) defines the role of the teacher as one who presents subject matter; 3) lifers don't accept responsibility for getting kids to want to learn; and most harmful of all 4) a lifer is one who expects a child to listen quietly and follow instructions for five hours a day and if they don't, then the child, the child's family and ethnicity is "somehow lacking and at fault" (p. 123). The before mentioned attributes are a *pedagogy of poverty.*

Teachers who excel and understand the high stakes involved for their children do not exhibit a pedagogy of poverty in the classroom. The main difference is that lifer/quitter teachers see innate ability as the reason for good achievement, where as the successful urban teacher believes that it is effort that leads to learning. That's really the difference in a nutshell. Successful teachers inspire effort, whereas lifer/quitter teachers demand compliance while they go through the motions of lecturing, assigning homework, grading, failing, and filling out discipline referrals. Successful teachers (Tribal Elders) know their students, know the parents of the students and most importantly, respect these parents. Successful teachers know the neighborhood, its history, its businesses, who are the elders outside the school who have influence, and star teachers respect the culture of their students as being one where the pursuit of knowledge is important, and star teachers appreciate the obstacles their students face just to get to school at times. Successful teachers also know the dire consequences if they don't teach with a sense of urgency. Failure to inspire learning can mean death to your students (Haberman, 2010).

Inspiring effort is difficult and can be exhausting, especially when the efforts of the star teacher are undermined by the "process is king" attitudes of large urban districts and if the inspiring of effort pedagogy appears to get in the way of the process pedagogy (i.e., MAP test preparation) then conflict ensues and the stress level increases. The successful teacher (Tribal Elder—in my research project) inspires his or her students to maximum effort, because they also have the ideology in the nature of students that they can learn and must learn for their survival (Haberman, 1997; Hilliard, 1995 &1997; Ladson-Billings, 1997; Tate, 1995).

Sociocultural Aspects of the Mathematics Classroom

Research that supports the Tribal Elder model of teaching is that which examines the sociocultural approach to identity and agency. This body of research is based on anthropological work of Holland (1998) and I kept this idea in the back of my mind while structuring my calculus classroom. Holland uses the term *figured worlds* where agents come together to construct joint meanings and activities. According to Boaler and Greeno (2000), a mathematics classroom is a figured world "because students and teachers construct interpretations of actions that routinely take place there" (p. 173). They go on to describe the mathematics classroom as a social setting where participants—"actors"—in this case teachers and students, take on certain roles to help define who they are. In their research project they examined the structure and tone the teachers set in in six different calculus classrooms in affluent neighborhoods in California and how these different *figured worlds* affected the mathematical identities and agencies of the students they interviewed.

They broke these classrooms down into two different kinds of classrooms, traditional and constructivist, and examined how the students reacted in each of them. Students in more traditional classrooms felt constrained and felt that the mathematics was happening to them and math (including calculus) was just something you memorized or did in class. The students made no connections to how the mathematics they were learning provided a connection to the outside world. This is relevant to this research project because I am examining how the teacher constructs the classroom environment to make a difference in how the students respond to the mathematics.

Nzuki (2010) also used the pioneering work of Holland and demonstrated how students interpret the worlds of their mathematics classrooms by examining the connection between the mathematical identity of African American mathematics students and their achievement. In this study Nzuki examined eight students where half self-reported as good in mathematics, the other half saw no future need of mathematics and had never done very well, but all the students had a strong positive identity with their race. All the students were in a remedial type class (Algebra III for seniors) and were encouraged to use graphing calculators. Nzuki studied how they negotiated their mathematical world with the calculator, how the teacher taught them to use the calculator, and how their achievement by using the calculator impacted their mathematical identity. An analysis of his data revealed that the student's identities were influenced by the constraints or opportunities in the figured world of the mathematics classroom (Nkuzi, 2010).

What Nzuki discovered was that high and low achievement happen in the same classroom regardless of the teacher. The high achievers displayed an incredible amount of resilience to the negative societal forces that permeated their lives. Whereas the low achieving students succumbed to these forces and had a fatalistic attitude towards mathematics. This meant that when they did poorly this is what they expected and there was nothing they could do about it. Nzuki posits that it is up to the teacher to counter this fatalistic predisposition by preparing inspirational and motivational classroom environments where the low-achievers are willing to take risks and discover that they really can do mathematics. Nzuki tried using graphing calculators as a source of motivation.

I found this research useful because I relied heavily on graphing calculators to teach the students about functions, finding the "zero" of a function, the rate of change of a function, and other operations where the speed of the calculator, and the fact that each student had one, made the lesson very effective. But, like Nzuki, a sidebar issue with my research was I wanted to see if the students were just becoming calculator whizzes, or were they really learning higher-mathematics.

This study is similar to the one proposed here in demographic of students, use of graphing calculators, and how the data was collected. It is different in that the researcher for this study will be the classroom teacher, thus this study will also examine the dynamics of teaching in an urban classroom.

In a study conducted by Chu and Rubel (2010), Rubel the university teacher educator and Chu the teacher in an urban classroom but going through an alternative certification program, examined the narratives of learning to teach mathematics in an urban environment. The key themes addressed included the nature of teaching mathematics, identity and position (this is similar to the figured world of Holland), and developing culturally relevant pedagogy.

This paper provides a framework for developing a culturally relevant pedagogy in a classroom. The researcher, Rubel, developed what she called the CureMap *Culturally Relevant Mathematics Pedagogy* (p. 60). The CureMap was arranged into three tiers, the first being to teach for conceptual understanding. This prioritizes the "making connections" of procedures and concepts as outlined in NCTM's *Standards* (2000), and not just focusing on the skills. This also means the curriculum must support classroom

social and socio-mathematical norms and facilitate student sense making as outlined in Cobb (2000).

The second tier is the inclusion of the "meaningful real world contexts" and structuring the instruction around students' experiences. A concept Rubel calls "centering." Though some elements of calculus may go beyond the students' experiences or be too complex at this stage in their mathematical lives, Rubel states, "we can also view centering in terms of opportunities for students to participate in mathematics" (p. 60). Thus you can keep the material abstract, but it is up to the teacher to allow all the students to engage in "sense making" of that material.

The third tier is to develop students' critical consciousness. While using calculus to teach for social justice and as Gutstein writes, "reading and writing the world through mathematics" (Gutstein, 2006), may be difficult, it is not difficult to develop students' critical consciousness in terms of thinking critically about mathematics (Skovomose, 1994). This lends itself to one of the main themes of ethnomathematics.

The paper is a discourse between the mentoring professor who developed this curriculum and the beleaguered second-year teacher trying to implement it. This paper is important to the current research because it provides a framework for categorizing the themes in the instruction by the researcher, and calculus, embedded in the CureMap curriculum, gives both a method for using calculus within a context of culturally relevant pedagogy and show how that might be implemented by a practitioner.

Boaler (2002) adds one more perspective in that she ties knowledge (attainment in the classroom), practice (teacher pedagogy taking place in the classroom), and identity (how students identify with mathematics) together and shows how each informs the

other. Boaler examined two types of calculus classrooms in two different high schools over a three year period. One classroom was taught in the traditional style, where the teacher had the authority, explained the mathematics, demonstrated methods on how to solve problems, and assigned abstract problems out of the text. In the other classroom, the instruction was discussion oriented, and the students had much more authority over their learning. There was "give-and-take" in the classroom as students tested their own methods and theories and the assignments were project centered. The second classroom was a much more constructivist classroom.

The study revealed three interesting results. The first result was that the AP scores between the two classes showed no significant difference. One could make two different arguments that the constructivist classroom was not any better than the traditional classroom, or one could say the constructivist classroom at least did no harm. But something more subtle was happening. Something beyond just comparing the mean sets of classroom test scores. When the researchers presented both classrooms with real-world problems, or problems outside the norm of the textbook, the students in the discussion-oriented mathematics classroom performed significantly better. And the reason wasn't because they knew more mathematics, the students from the discussion-oriented classroom performed at a higher level because they showed more perseverance. These students seemed not too concerned with finding the "right" answer but more interested in the "puzzle" of the problem and wanted to see where their own personal conjectures led. This positive agency towards mathematics which in turn leans towards problem solving, proof, and communication is a beautiful illustration of the process standards of the NCTM.

The last interesting finding from this study was the difference in "attitude" toward mathematics of the students. Students from the traditional classroom saw mathematics as an abstract discipline, and many failed to make the connections to the outside world. These were good students in mathematics, but many felt this would be their last math class. On the flipside, many of the students in the discussion-oriented class, enjoyed mathematics and wanted more. This finding leads to how the "mathematical identity" of these students is formed.

Thus the practice and discourse the students were experiencing had a direct impact on their mathematical identity. This has direct implications to how we train urban teachers and what the best practices are for the classroom; both are significant to this study. Does a focus on the standardized test and course "benchmarks" adversely affect to an even greater degree, the already fragile mathematical identity of our urban students due to the racialized context of their mathematical socialization? That question is beyond the scope of this research, but the question does focus on how practice, knowledge acquisition—and the type of knowledge one acquires—leads to an effect on the identity of the learner.

Graphing Calculators

Technology is one of the six principles in the NCTM *Principles and Standards*(2000). The NCTM claims that technology influences what is taught and enhances learning. They also assert that technology (the NCTM uses technology for calculators and computers), if used appropriately, can cause students to learn mathematics more deeply by testing conjectures, and working at higher levels of

generalization or abstraction. The sticking point with technology though, has always been that sticky phrase, "if used appropriately."

Elliot (2003) did a meta-analysis of 54 research studies and found that students' operational skills and problem-solving skills improved when calculators were an integral part of testing and instruction. The results for both skill types were mixed when calculators were not part of assessment, but in all cases, calculator use did not hinder the development of mathematical skills. Also Elliot found that students using calculators had better attitudes toward mathematics than their noncalculator counterparts Elliot, 2003).

Examining the effects of graphing calculators on the students in this research is of limited scope. Nzuki (2010) highlighted the inequities in technology between minorities and whites which much research has shown that even when they had the physical access to technology, many racial minority students and low-SES students were likely to use technology for drill-and-practice activities that involve lower thinking skills.

Nkuzi went on to point out that this just exacerbates the inequities between racial groups in mathematics education. Further, the inequities in the use of graphing calculators are more likely to arise because of how the calculators are used in the classroom, as well as from access to them. The extent of the instruction that low-SES and minority students receive in the use of this powerful technology is limited at best. Thus, current deficiencies in the ways technology is used in classrooms violates the technology principle of the NCTM. Further, the research has shown that student use graphing calculators display better understanding of function and graph concepts, demonstrate enhanced problem-solving skills, and score higher on achievement tests for algebra and calculus (Nkuzi, 2010).

Though the use of graphing calculators is not the focus of this research project, it will have an impact. A pitfall of the teaching with technology is that the power of the technology supplants the thinking of the human beings using the technology. Students and teachers become so centered on "getting the answer" the real mathematics is left out and the calculator does the work. In teaching, one must avoid this and cause the students to use the graphing calculators in meaningful and creative ways. In my field notes and reflections I wanted to see the effect the calculators have on my teaching. Did I encourage creativity and problem solving, or do I just show them "tricks" to get the right answer?

Summary

For too long, mathematics has been a stumbling block and not a door to success for our marginalized students of color. Robert Moses writes that the civil rights struggle of the sixties provided political equality in that people of color now had the right to vote. He claims that to not provide an equitable mathematics education to our students is to cut them off from society and the economic mainstream. It is hoped that this study will provide a framework in curriculum and instruction that models a way practitioners can reach African American students so they can develop a strong motivation to study and succeed in mathematics. The ultimate goal is that these students will take ownership of their learning of mathematics and demand the equitable and just mathematical education that has been denied them.

When African American students question the need to study mathematics, it is a legitimate question steeped in the history of their experiences, at times, traumatic educational experiences as African Americans. In this African American experience,

education meant freedom. To be educated also meant you were a leader of your people. By using calculus and also dismantling the authoritarian model of the "teacher"—also known as the "lifer/quitter" that the above cited research and my personal experience know is so prevalent in the urban core—I wanted to craft a new school culture where the teacher is seen as the Tribal Elder. The Tribal Elder way of teaching borrows from the work of Moses on the Algebra Project. The Tribal Elder way of Teaching establishes the ethos envisioned by D'Ambrosio in his praxis of ethnomathematics. The Tribal Elder way of teaching is informed by the work of Lipka where he actually used Tribal Elders of the Yu'pik villages to teach the mathematics of these Native Americans and then translated that mathematical experience into the Western cannon of mathematics. Lastly, the Tribal Elder way of teaching looks to the rich heritage of learning found in the ancient cultures of Egypt and Africa to inspire those of African descent to follow in these footsteps and learn the high level mathematics developed by their own people. Will this craft a school culture of achievement that has salience for students? Can the students see mathematics in the 21st century as liberatory as their ancestors saw literacy in the 18th century? This is an important question addressed in this research that could have far reaching implications for the teaching of mathematics to African American students. And most importantly, is this method of teaching practical for other teachers in the urban core? That is the real goal of this research.

One troubling aspect of the research that guides us to using calculus is that the mathematics used in the research thus far was rather elementary (Frankenstein, 1987, Gutstein & Peterson, 2006, 2005, & Gutstein, 2006, &Strutchens, Johnson, & Tate, 2002). Much of the mathematics is little more than a comparison of numbers. In

Rethinking Mathematics (2005), most of the mathematics would be very relevant for a cross-curricular course with the social studies department. Besides the NCTM *Standards* standard of managing data and graphs (NCTM, 2000), higher mathematics is non-existent. This is not to say that these units didn't require great cognitive skill and did not add to the critical awareness of students participating in such work; quite the contrary. The problem is that the critical aspects of the curriculum are washed out by the media and critics claiming that "multicultural mathematics" is "dumbed" down mathematics (Greeno, 2000).

This research project was unique in that it used the higher mathematics of calculus and names a certain pedagogical style—namely that of the Tribal Elder. As explained earlier, cognitive researchers have shown that by using culturally responsive teaching leads to increased sense making on the part of learners (Davis, M. K., Hauk, S., & Latiolais, M. P., 2009). Also, African American students recognized that their culture had a rich mathematical heritage (Eglash, 2006, Ladson-Billings, 1994, & Tate, 1997) as we (the students and the researcher) think critically about who creates mathematics and for what purposes. This was an emancipatory experience that may spark an interest in taking higher mathematics by these African American early high school students. Taking a higher level of mathematics, the data shows only increases the chances of success in college.

But college can also be seen as a White construct of success. The idea that the African American struggle for education and just for life itself is a success is lost on the dominant culture. Teachers of African American students need to understand that struggle and adapt their teaching methods to meet the needs of their students and not try

methods where the students are forced to change who they are so that the White teacher is comfortable in the classroom. This is especially true for teachers of students in the urban core. College is not the goal—that's my White worldview goal for them. The goal is that we teach them to survive and lead happy lives.

To conclude this summary I wish to compare the objective of the Yupit School District in the "bush" of Alaska that serves Native Yu'pik children, with the dominant culture district objective of the Liberty, Missouri School District. The Liberty objective read, "As stewards of discovery, we will embrace innovation to instill a passion for life-long learning that will best serve our nation and the world in the 21st Century." Meanwhile the Yupit objective, though a little similar, yet still very different reads, "The Mission of the Yupit School District, working with Yuuyaraq as a foundation, is to ensure all children are happy and able to learn and succeed in any environment." The purpose of this research is to be able to provide a practitioner framework so that a child who grew up in Liberty and wants to teach those Yu'pik children, will be successful and also happy practicing his or her craft (not science) in Yupit.

CHAPTER 3

METHODOLOGY

Restatement of Purpose and Research Questions

Purpose of the Study

Much has been much written on the culturally relevant pedagogy in mathematics education (Cobb, 1994, Ladson Billings, 1994, Leonard, 2008,Moses & Cobb, 2001, Strutchens, 2002; Tate, 1995,) and on instructional techniques that appear to be effective in teaching African American students (Davis, Hauk, & Latiolae, 2009; Harvey & Stiff, 1988; Hilliard, 2004; Ladson-Billings, 1994, 1997 & 1998; Moses & Cobb, 2001). But, as Leonard (2008) states: "While there is a lack of research studies that examine culture as a basis for learning mathematics, Demmert and Towner's (2003) meta-analysis highlights several research studies that show promising results." She goes on to discuss studies done with small children, etc. but none dealing with high school or with mathematics. Later on the same page (p. 11) she says, "Quasi-experimental studies on the use of culturally based education in mathematics classrooms, however, have been difficult to conduct." As a practitioner, I have tried culturally relevant lessons in my room, and found the entire enterprise lacking. My culturally relevant lessons were lacking I believe for two reasons: 1) I felt uncomfortable with some of the material. As a White teacher, when I find myself bringing up racial discrimination issues, I could sense the tension in the classroom and I became very uncomfortable (as it should have been). The students also felt uncomfortable and you could just see this dark cloud was lifted

when we would change the subject and go back to math.[1] 2) The mathematics I found in many culturally relevant lessons was in most cases rudimentary data collection and analysis which is an important facet of learning mathematics, but it's not rigorous in an abstract way, and the mathematics was very utilitarian. Both these attributes of rudimentary statistical lessons are in violation of D'Ambrosio's praxis of ethnomathematics which is to provide non-utilitarian (or "dead") mathematics and teach exciting mathematics (D'Ambrosio, 2001a). On the flip-side, when I tried to use Eglash's culturally situated design tools, I found the mathematics difficult and I spent several weeks just getting the students up to speed just to tackle one lesson (Eglash (2005).

What I have discovered happening in my classes from the past that fit the literature was culturally responsive teaching. In other words, through close observation of my students, immersing myself in their culture, keeping my ear to the ground on what was happening in the neighborhood, and participating fully in the Rise Up Family Night and being available to the parents —from knowing and learning who the respected elders were, both legitimate and gangsters—and getting to know the history of the neighborhood, It seemed I could adapt my teaching to fit the style and flow my students found comfortable, rather than spending an inordinate amount of time trying to get them to conform to "normal" White middle-class standards of school. Establishing these types of relationships with the students and then teaching them how to navigate a hostile world, are all the actions of a Tribal Elder.

[1] Please note, I am not saying that mathematics is culture free. It's just a simple fact, I teach math and physics, I am not an expert on race, nor do I feel equipped to handle such troublesome discussions on a routine basis.

The above gives a basis of my research objectives, but there is really just one purpose for this study, as I stated in Chapter 1: I want to know what it is that I do in the classroom that makes urban kids want to do mathematics. That seems rather bold, maybe even arrogant but I have evidence that there is something in my teaching, where I appear to have a knack for building the relationships required to teach mathematics at a high level. I want to know why it was when I taught in some of the "toughest" alternative schools in the city did I get some of the most incorrigible students to skip gym, and come to my classroom? Why did I wind up with 33 kids in my class when another veteran teacher with the same credentials and same ethnic background of the kids only have six students? Why did my "alternative kids" excel on the MAP test for them--all nearing proficient or higher, a few actually proficient and the rest of school and the city did abysmally? Though these are not research questions, they provide the framework from which I designed the study. Therefore the purpose is to carefully examine my classroom and use qualitative methods to determine if themes emerge that other teachers can then adopt so they might have the same success. This research is practitioner focused where insights gleaned can be passed along to other practitioners. This study is a phenomenological case study that will contribute to the body of knowledge for using culturally relevant teaching in a classroom African American students.

Research Questions

The following research question was investigated in this proposed study:

1. How does a white teacher in an urban classroom become a Tribal Elder teacher?

What does that look like? And what is required of the teacher? These next questions are under the umbrella of the first question of how a teacher becomes a Tribal Elder teacher.

2. How does a white teacher effectively adapt to the culture of an urban classroom?
3. Can a white teacher effectively adapt to the culture of an urban classroom and teach rigorous mathematics, such as calculus, in a style that's comfortable for the teacher and motivates the students?

All three questions are practitioner centered. Calculus is very abstract and some of its applications to the real world such as in physics, engineering, and economics, and applying these real world applications are quite beyond the scope of a six-week summer session with 9th and 10th grade students. Though calculus may be too abstract to center the instruction around the experiences of the students as suggested by the research on culturally responsive pedagogy, a teacher can still center the classroom in terms of opportunities for students to participate in mathematics (Chu & Rubel, 2010).

After an extensive review of the literature, it appears, to this researcher, that a disconnect exists between critical theorists, critical race theorists, and finding a pedagogy that is effective. Simons (1995) found the same disconnect between constructivist learning and teaching theory. Critical theorists and critical race theorists are restricted from an epistemological standpoint to prescribe any effective pedagogy that is culturally relevant and leads to an emancipatory experience by the students. What few examples exist in the literature of this type of pedagogy (Gutstein, 2006 & Strutchens et al, 2002), the mathematics is not that rigorous. This research added to the body of knowledge

because it attempts to intertwine culturally responsive teaching[2] with higher rigorous mathematics.

Action Research

According to Gall, Gall, and Borg (2007), action research fits into to purposes where one is *personal,* and the other is professional. In the personal realm, the researcher is focusing on his/her students and teaching methods. The teacher is trying to develop a greater understanding of their students' thoughts and actions; the teacher is trying to develop a deeper understanding of certain curricular innovations; action research provides an opportunity for the generation of theory. The three professional purposes are engaging in action research as a form of staff development; action research is a way to legitimize their role as producers of knowledge on educational research and theory; lastly the action researcher wishes to develop networks of practitioners engaged in action research to promote their "colleagueship and professionalism" (p.599). The purpose of this action research project fits more comfortably into the realm of the personal, yet a very real outcome of this research was to legitimize my role as a producer of knowledge. The knowledge for this research project was models of teacher behavior that promotes learning in the classroom.

There is a third purpose of action research and that is for political purposes. According to Zeichner and Noffke as quoted in Gall, Gall, and Borg (2007) "all forms of educational research embody particular political stances, either to maintain existing lines

[2] This research project is focused more on culturally responsive, vice culturally relevant pedagogy. They are very similar, but culturally responsive pedagogy, to this researcher, implies the teacher adapts to the culture of the students so that the subject matter, which is very abstract and foreign, is not given in a foreign context within the classroom.

of power and privilege or to transform them along a more just and caring lines." Doing action research for political purposes seeks to make one's own practice more just and humane and embrace an agenda of social change. Upon reflection, I did have a political agenda for this project in that I wanted to provide a framework—the Tribal Elder as teacher—that other teachers of children of color could use to exact social change within their classroom. Issues of fairness and equity in the mathematics education were discussed extensively in the previous chapters. It was the intent of those chapters to point out that there is a lack of fairness and equity when it comes to the education of our children of color. One question that kept recurring in my mind as I worked on this project was, "what types of actions can a teacher do in their classroom that promotes social change for the common good?" Thus an undercurrent of this research was to provide a model for social change. The impact, or at least the perceived impact by me, of the seeds of social change that may have been planted are discussed in Chapter 4.

A significant portion of action research revolves around *reflection*. Reflection is the process in which practitioners step back from the fast-paced and turbulent world of their classroom to ponder and share ideas about the meaning, value, and impact of their practice. From this process new insights into the strengths and weaknesses of their current practice are gleaned. The reflections that occur through the autobiographical narrative and journaling identify problems in practice, highlight issues or assumptions in their own beliefs about teaching and learning, and suggest personally relevant interpretations of the data collected. This self-inquiry portion of the action research project provides an avenue for self-growth of the researcher. Questions as to what the

researcher discovered of him/herself not only as a teacher and researcher, but also as a person are important to the cycle of action research.

The cycles of action research are 1) to select a focus. This project the focus was my Rise Up classroom and the dynamics that made it a successful or unsuccessful or unsuccessful. Next the researcher collects data and then begins the iterative analysis of that data. Both of these aspects are discussed below. Based upon the data and analysis, action is then taken, followed by more reflection, a modification, and then a new focus may emerge. This cyclical nature of action research means that there is no neat ending to the "story." But further investigation, using the same methods continues.

Research Perspective

The nature of this action research project research inherently requires qualitative inquiry methods. Evelyn Jacobs describes the qualitative tradition as "a group of scholars who agree among themselves on the nature of the universe they are examining, on the legitimate questions and problems to study, and on legitimate techniques to seek solutions" (Gall, Gall & Borg, 2007). Tradition in this sense refers to the body of research and the theory generated by these scholars. This research is in the tradition of cultural studies and critical-theory research. This tradition involves the contestation of oppressive power relationships in a culture and seeks to find avenues of emancipation for the participants (Herr & Anderson, 2005; Reason, 1994).

For this purpose, the researchers should take the position of participant and try to see what meanings they ascribe to their actions, why they act the way they do, and what purposes do they think are served by their actions. This of course means that researcher bias is inherent in this type of study. A perceived significant limitation to this study is

that I will be participating in the teaching of calculus to the students. Thus the potential is there for me to bring considerable bias to the research and to the findings. Meeting the five requirements of a critical researcher alleviates some of this concern. The five requirements of the critical researcher are: The first is that critical research rejects the notion that all educational issues are technical and not political or ethical in character. Secondly, as Kincheloe (2001) points out, critical researchers, "[M]ust be aware of the interpretations of educational practices held by those who perform educational acts. "The self-understandings of educational practitioners who are reflective will lead them to be conscious of their own value-commitments, the value-commitments of others, and the value commitments promoted by the dominant culture" (p. 42). Thirdly, "critical research attempts to unveil false consciousness while providing methods for overcoming its effects" (Kincheloe, 2001, pg 42).[3] Fourth, critical research must point out where the dominant culture is blocking attempts by society to right certain wrongs. And lastly, "Critical research is always guided by an awareness of how it relates to practice. Its purpose is to help guide the work lives of teachers by discovering possible actions they

[3] An example of a "false consciousness" would be the myth centering around the "American Dream." The idea is that the United States is the "land of opportunity" and that through hard work and a rugged individualism, nothing will hold you back. This American ideal is part and parcel in the curriculum, the posters around the school, and the attitudes of the teachers, who 84% are white middle class. But the reality that is experienced by our citizens of color is far from the ideal. Barriers of entry exist no matter how well qualified one may be. There exists a large gap in earning power between white and citizens of color. And as was pointed out in the research in chapters 1 and 2, two things can happen to our children of color that is not very "dreamy": 1) Upon entering a classroom too many times it is assumed they will be "slow"; and 2) when they do perform well, they are not recognized for their achievement. So the question becomes, how can one achieve the "American Dream" if when you are even allowed to "achieve," you don't get to reap the rewards? I could have probably summed up what is meant to critical theorists as a false consciousness with three words: " Celebrating Columbus Day."

might take if they are to overcome the obstacles and social structures put in their way" (Kincheloe, 2001, p. 42). That last point frames this research.

This research of "looking at things from the inside" involves the researcher as a first-person participant. Ball (2000) claims that first-person researchers need to distance themselves from the work. This type of research is such that it requires an unusual concentration on, and use of self, combined with "an almost unnatural suspension of the personal" (p. 400). I used this as a guiding principle in my research to a point, but then I found that what Kincheloe explained about teachers "discovering possible actions they might take" required my total immersion into the students thinking and actions, and my actions as a teacher. Thus between Ball's requirement for a teacher-researcher to distance themselves from the situation and Kincheloe's undergirding premise that critical research needs to make discoveries of practice in the moment, caused me, as the practitioner-researcher to be whipsawed to some degree between the two competing research stances. I found myself while in the throes of teaching and while the class was firing on all cylinders (fully engaged), to suddenly have a still small voice go off in my head saying, "You need to make sure you write this down!" And through my field notes, that is exactly what happened.

Using my field notes alone creates a danger that too much of my bias may seep into the findings. Yet, it is the researcher's professional point of view as a practitioner that is most compelling to other practitioners. The anthropologist Patricia Behar wrote of these struggles in how to gauge this type of research in an "appropriate scholars" voice. When the author is completely removed from the writing, this can produce texts that are at worst boring and unenlightening. On the other hand, on the other extreme, "author

saturated texts" has the potential to be humiliating, embarrassing and useless unless one can connect the particulars of ones own perspective and experience to the study with theory and practice. Otherwise, the research rises to the bait of critics claiming the research to be nothing but "nouveau solipsism" (Ball, 2000).

Doerr and Tinto (2000) shed more light on the inherent problem of first person research by writing, "Thus the fundamental dilemma posed by any first person research project, then, is to understand how to move beyond the particular story told by a skilled reflective practitioner in order to understand, critique, and foster the development of the new knowledge that is embedded in theory and practice" (p. 400).

Two guiding principles are provided by Doerr and Tinto (2005) to assist in the defusing of this dilemma. They are:

1. The primary purpose of first-person research is to simultaneously study and generate knowledge about the very practice that it seeks to change.
2. The practice is carried out by the practitioners but in concert with university researchers.

In consideration of the above, this research project came down heavy on the side of the first point; and the second? Not so much. Yet just by having university researchers approving my proposal, my keeping them informed of any changes, and my constant contact with my advisor on the frustrations, joys, and "discoveries" and then my advisors sage responses, fits nicely into criteria two.

The limitations of any qualitative research, is the generalizabilty of the results. However, generalizability is not the intent of this research. As a critical theorist, my epistemological stance finds the positivism imposed by the mere word "generalizabilty"

somewhat repugnant. There is not a prescriptive formula to teaching.[4] It is an art, blended with the science of child and brain development, but my epistemological belief is that teaching comes down heavy on the side of art. Teaching is craft and human interactions are unpredictable, messy, joyous, heart breaking, and have elements of everything in between. I liken teaching to the art and craft of acting. Oh sure we have "method" actors, but that is just one way to go about their craft and in the throes of a presentation, the nuanced additions and deletions of the "method" are what make for a compelling performance and an uplifting experience for the audience. The same can be said for teaching. To take this argument to its conclusion, I find the requirement of "generalizabilty" to be a limitation to practitioner research, not the other way around. This research project is with a select group of students, so therefore some of the pedagogies may not be valid to some practitioners in their particular classrooms.

Considering the purpose and research questions, case study design was employed using as a methodological framework in phenomenology. Phenomenology provides a good theoretical framework for this study because it is situated in critical theory and critical race theory and it recognizes understanding one's subjective interpretation of individual's lived experiences. "A phenomenological study describes the meaning of the lived experience for several individuals" (Berry, 2008).

This research project explored the phenomenon of the students' mathematical socialization through calculus and my socialization to adapting to the cultural norms of their classroom. By me adopting the norms they feel comfortable with in the classroom, I

[4] Though the publishers of the ineffective (and demeaning to the very professionalism of teachers) "canned" curricula that have been adopted in many urban school districts would want you to believe otherwise.

am taking on the identity of the Tribal Elder in that I am a "trusted elder" who will help them navigate the difficult and abstract world of calculus. I used qualitative coding methods and theory building to interpret the findings. As stated earlier I want to know what it is that I do in the classroom that makes urban kids want to do mathematics. I have formalized these preceding questions into my research questions. The purpose then is to examine this phenomenon so that other practitioners may have a model to emulate.

Though the instruction in my classroom may not have seemed to me (after doing research in the Freirean model) constructivist and in a liberatory style, because it seemed to me at the time that all I was doing was the "banking system" of teaching. But upon further reflection, I've noticed that what I was doing in my classroom was culturally responsive teaching. This culturally responsive teaching came down to nothing more than a little mutual respect. I wasn't doing anything other than knowing my students--I mean really knowing them--providing a safe place for them to be, and setting high expectations. I didn't have too many "cultural" things in the room, nor did I fall back on a heroes and holidays approach.[5] I did have them research modern day African American mathematicians and physicists so that we could debunk the White male myth of mathematics (Stinson, 2010). But in my urban classroom experience, I didn't do much different than if I was teaching in a white suburb except use a little of their language, understand somewhat how they like to engage in class (an example would be to work in groups), and knowing that teaching them mathematics was not going to happen on a deeper level unless we were each committed to each other—a solid relationship was built.

[5] In fact, I am growing very wary that the only African/African American mathematician our kids of color (and their teachers!) know is Benjamin Banneker.

In the *Dreamkeepers* (Ladson-Billings, 2004), Sister Rosie was very successful at teaching algebra to sixth graders (somewhat teaching like calculus to ninth and tenth graders) by doing pretty much those things described above. These culturally responsive techniques and evidence of them are outlined in Chapter 4.

In the phenomenon examined is that I taught calculus to a group of African American students who had limited if no experiences with such mathematics. The objective was to determine what classroom dynamics took place that either helped or hindered the teaching of calculus, the mathematical socialization of the students, and what I did to become their Tribal Elder. This is how I define a "culturally situated" classroom. As the research question asks, how does a white teacher in an urban classroom become a Tribal Elder (which is my way of saying—how do you develop trust and mutual respect and what does that look like)? Will this be a unique mathematics experience for them and thus impact their mathematical socialization in a positive way? Given that the literature overwhelmingly portrays culturally relevant mathematical practices as exercises in data collection and then applying rudimentary statistics (the units are much more akin to social studies units with a small dose of mathematics rather than the other way around) using calculus makes this a phenomenon.

A secondary phenomenon examined was whether this Tribal Elder theory of teaching exemplifies the Freirean model of leading the students to make critical connections with their outside world. These connections are not confined to just events or experiences of the world. The subject of calculus itself, and the "knowing" of calculus and whether that "knowing" has any real value to the students is an important part of the critical piece to this research. Another critical aspect is that the students can question

critically "gatekeeper" mathematics courses. Much as Moses (2001) examined how algebra is used as a gatekeeper course for junior high students (8th graders going into high school), this will allow college track African American students to critically examine how calculus is used as a gatekeeper course at the college level.

Participants and Context of the Study

In this phenomenological case study, I was the classroom teacher of high school-aged African American students participating in the six-week summer portion of the Reach Up[6] program. Reach Up is a program for high-school students who have college ambitions, but might have trouble attending because of lack of funds, low grades or inadequate high-school preparation. Reach Up is federally funded and my Midwest, urban university is the host institution. The purpose of Reach Up is to help students improve study skills, build confidence, motivation, self-discipline, maturity and better grades so that they can go to the college of their choice. Students selected have demonstrated academic promise, are "first-generation" college students, and have been selected from the city's urban core high schools. The students I taught were all African American except one Hispanic girl and represent a wide mix of SES from middle-class, working class, to families at or below the poverty line. The Reach Up program is housed on campus. I have ten years of experience teaching high school mathematics in the urban core and many years experience teaching mathematics and physics at the college level, both as an adjunct and full-time instructor.

I taught two classes in the morning on Mondays through Thursdays. The students were randomly divided up into the two classes, thus we had a mix of students

[6] Reach Up is a pseudonym for the program.

who were either just entering the ninth grade—"rising freshman"—to those who were rising seniors. This created some interesting dynamics and great opportunities for the older students to take on mentoring roles themselves. The guiding philosophy of the Reach Up program is to give the students a structured college experience. The curriculum is left entirely to the discretion of the teacher. This allowed me the flexibility to design the class around a calculus unit.

After I received the approval of the Social Sciences Institutional Review Board, students and their parents were informed about the study during the Rise Up orientation, and consent forms were passed out to the parents. All the parents signed them. Once classes began, I got the informed assent forms signed by all the students. The Rise Up staff is very supportive towards research involving their students. The parents are also very supportive of any research efforts involving their children.

Gaining Entry and the Researchers Role

This study was conducted from June to August of 2011. This was my third year of teaching with the program and during the academic year I spent several hours a month with the students during their on campus time. This allowed me to establish a favorable rapport with the staff and students prior to this study.

Data Sources and Collection Procedure

A number of different kinds of data were collected in order to understand the nature of the classroom practices and the mathematical experiences of the students. Collecting so many types of data allowed for the triangulation of the data. The sources for the collection of data were the Mathematical Biography (Appendix D), audio recordings of several interviewing sessions during and after classes, my own field notes

which include my "grading" of student work, instructor reports to the Rise Up staff, and an End of Session survey the students completed the last day of the session. I designed the curriculum around my old college calculus book that developed the idea of the derivative from a detailed instruction of the line, more advanced functions, and examining the rate of change of a function. These lessons are included in Appendix G.

At first blush of the lessons, one may think they look rote, and one may have the opinion they are just one notch above the infamous "fraction worksheets" of urban education. The lesson sheets provided a shell; an outline of the class. How the class discussions were conducted, any scaffolding of mathematics that was needed, and the actual mathematics work of the students provided the substance of the data. It is also my epistemological stance that instruction trumps curriculum, and that the curriculum just provides a framework for the teacher and the students to study deep mathematics. The intent was to avoid what Anderson (1990) calls the six pedagogical disasters in education. These six are: 1) separate mathematics from algebra; 2) teach mathematics without historical reference; 3) use cryptic textbooks; 4) not work in groups that benefit the whole class, but rather teach to individuals in a competitive environment; 5) teach math as a complete abstraction thus it has no place in one's own environment; and 6) depend on rote memorization. Avoiding these pitfalls provides the students with a Freiren learning experience.

Data Collection

Data was collected by qualitative means with one exception; the end of session survey. At the beginning of the summer session, the students were asked to write a mathematical biography. I have used this as an "assignment" in previous summers and

some of the biographies come back with very detailed answers to the questions. Others have been a little sparse. Since it was a "graded" event this could be perceived as undo influence by the participant/researcher, but many of these students don't know how to express their ideas, especially to open ended type questions. I gave them ample time to do the assignment—a weekend and two days. The Rise Up staff who supervise the students during their six week stay on campus made sure the biographies were completed. Their assistance throughout the study was invaluable. All the biographies were used because I had parental consent and student informed assent to use all of them.

The biography questions were designed by Berry (2002) and concern each student's perceptions of mathematics and school, their perceptions about their ability to do mathematics, and to find out whether they individually perceive themselves as successful in mathematics. The questions and format for the biography are found in Appendix D. These biographies were coded under the cases in the field-dependent categories *identity*, *security,* and *validity* which are explained below in the data analysis section.

Audio session interviews were conducted at the conclusion of four class periods. I asked pointed questions about their teachers, their attitudes toward mathematics, study habits, and math classes in general. These conversations had the consent of all parents and the informed assent of the students. These were also coded under the categories of cases listed below. In addition, two hours of interviewing took place in the cafeteria during their lunch period towards the last two days of the session, and interviews were conducted at the graduation ceremony. The purpose of the interviews was to gain insights into the participants' experiences and perceptions. The interviews were conducted in

pairs or groups of threes because research has shown that group interviews illicit richer responses than do individual interviews (Cobb, 2009). During the two hour session I had six different groups talk for several minutes. Groups were loosely defined, as I allowed the students to come and go as they pleased. A total of fifteen students of the 29 were interviewed. These periods were transcribed using transcription software.

As a critical theorist, I shun high stakes tests as a metric to verify student achievement. The biggest problem with high stakes tests is when they are the *only* metric used to measure achievement or teacher competence. It is akin to looking at one box score for a major league baseball team to determine the effectiveness of their season. But effective teachers are always making formative assessments of their students. These assessments are both quantitative and qualitative so that a more detailed picture of each student's growth can be assessed (Miller-Jones & Greer, 2009).

In this research a pre- and post-test were given to the students. The pre- and post-tests are an annual requirement of the Rise Up program and I determined it would provide a good partial metric for measuring the students' growth. The pre- and post-test scores are discussed in Chapter 5. These scores are not evaluated quantitatively, that would be absurd because I could have taught them the test over the six-weeks.[7] In Chapter 4 I examine, in conjunction with my field notes what was going on during both testing sessions, the attitudes of the students for the first test and their attitudes about taking the post-test. Which provided a more descriptive picture of their growth. An example of the pre and post-test are provided in Appendix F.

[7] This is pretty much what happened as the pre- and post-test followed the structure of the scaffolding of the curriculum.

A post session questionnaire was also given to the students on the last day of the summer session (Appendix I). This questionnaire coupled with the pre- and post-test gives us a glimpse, but only a glimpse, into their growth and their attitudes towards mathematics and ultimately the effectiveness of the summer program.

Data Analysis

According to Gall, Gall & Borg (2007) reflective analysis is "a process in which the researcher relies primarily on intuition and judgment in order to portray or evaluate the phenomenon being studied" (p. 472). Reflective analysis is ideally suited for generating thick description, but it can also lead to the discovery of constructs, themes and patterns.

Triangulation was achieved from the three data collection methods mentioned above. All the textual data were assembled after the five-week class. Analysis was guided by the broad theoretical conceptions of mathematical socialization and identity, as well as from the pedagogical perspective of culturally responsive teaching (CRT). These paradigms formed the broad categorical themes for coding the data. Analytic codes were developed for data processing using open coding to generate as many codes as possible (Emerson, Fretz, & Shaw, 1995). Rereading of the data will use focused coding in order to group codes and infer connections among them. From this iterative process key analytic and explanatory themes as well as patterns and relationships to emerged from the analyzed data.

The first phase consisted of working through the entire data set in chronological order and I made conjectures about general and specific instances where as the teacher I engage in practices which might impact the learning in a positive way of my field-

dependent learners. Written assignments were a part of the data set as well as responses to the biography questions for evaluating the students' mathematical socialization. These conjectures were tested by using coding software. The coding sought to establish evidence of the Tribal Elder from me and the mathematical socialization of the students. In the second phase of the analysis, conjectures and refutations were produced empirically grounded accounts of general and specific examples of validity, security, and identity and their occurrence. These accounts consisted of mutually reinforcing assertions spanning each data set, which grounded assertions about student growth, my cultural competence and sociopolitical competence (Ladson-Billings, 1998). In addition, codes were established to fit the cases of field-dependent mathematics instruction (Stiff & Harvey, 1988). The process of delineating classroom norms involves identifying patterns in the interactions between the students and the instructor-researcher. The themes that emerged are listed in the subheadings of Chapter 4. Themes expressed by the students are: High self-esteem and confidence toward mathematics; Negative mathematical experiences; Negative experiences turned around by a caring teacher; "Everybody gets it" and "breaking it down". Themes of the teacher researcher fell under the broad category of *Actions of the Tribal Elder Teacher* which are Circular lines of authority and Tiffany and Essence.

Field-Dependent Teaching

Research indicates that African American students are characterized as "field-dependent learners. They view the world as a unified environment with inherent order for which relationships are the focus. African American students are more likely to approach problems holistically, thus they prefer to use descriptive modes and view the

world in relative terms (in context). In addition, benefit to the group is valued and, consequently cooperation among all parties is acceptable behavior (Harvey & Stiff, 1988). Based on this I focused my pedagogical norms to fit the students' norms for a classroom. Field-dependent teaching brings three themes together which forms a culturally responsive triad to teaching. The triad includes identity, security, and validity. These three themes were used as cases for the qualitative software used to assist in building the theory of the Tribal Elder.

Identity

In Chapter Two of this project, much attention was paid to the disparities of instruction (Hilliard, 1995; Leonard, 2008; Moses, 2001; Perry, 2004), the attitudes of white teachers to African American students (Du Bois, 1960; Hilliard, 1997), and the inherent racism found in the Eurocentric style schools situated in this country (Hilliard, 1997. All these forces have a very negative effect on the identity of the African American student. Over and over, African American students are told they are not appropriate mathematical students and this forces them to accept the cultural bias of the classroom or become identified as "uncooperative." This gives them a sense that they do not belong and gives them a loss of identity (Harvey, 1984). Developing a sense of belonging might give the students a positive identity in the mathematics classroom. In this research project, identity became a case for coding the transcriptions of interviews and the students' mathematical biographies.

Security

Field-dependent learners need support from fellow classmates as well as from their teachers. African American students seek out opportunities to work together. In

Eurocentric classrooms students are encouraged to develop their math skills independently and they are seen as lazy or stupid if they want to work together (Anderson, 1990). By allowing them to work together, students develop mathematical and social skills. Also, teachers with a Eurocentric view of the classroom fail to recognize that this collaborative effort gives African American students a sense of security (Harvey & Stiff, 1988). A Tribal Elder teacher recognizes this need to work cooperatively as an expression of faith in the abilities of his/her students. Tribal Elders create a safe classroom with high expectations where effort is valued as well as triumphs are recognized. In this research project, the high expectations were that a group of mostly freshmen were going to learn a little calculus. Student achievement was pointed out to others in a low-key fashion at times (i.e., through the notes I made on their homework), and at other times a student who did an exemplary job or showed a vast improvement, or finally had that illusive "mathematical break through", these classroom events were acknowledged before the entire class. Security was a case that was coded from field notes, transcriptions of interviews, and mathematical biographies, and from the post session survey.

Validity

Tribal Elders validate the actions and the performance of students. This is done through isolating success in a difficult problems and offering encouragement to keep trying. These teachers also have a multicultural perspective and sensitivity that is rare in Eurocentric classrooms (Harvey & Stiff, 1988). Validity was coded as part of the theory building of the Tribal Elder.

All three of these themes were put together and analyzed qualitatively to determine if positive effects were occurring on the mathematical socialization of the students to the teacher. Vignettes of these types of interactions by providing rich description are detailed in Chapter Four. But the dynamics of the classroom is a two-way street—students coming to terms with teachers and on the flipside, teachers coming to terms with students. The next three attributes concern how teachers come to students to create a "Tribal Elder" classroom. These three attributes were analyzed to examine qualitatively teacher competence.

Teacher Competence

Educational researchers have identified three *competencies* of teachers who are successful teaching African American students. These are 1) student achievement; 2) cultural competence and sociopolitical consciousness (Ladson-Billings, 1998). These three competencies are described below and they became themes for coding and qualitative analysis towards building a theory of Tribal Elder teaching in the classroom.

Student Achievement

Student achievement may seem self evident, but in this context it means getting the entire class to excel. Individual performances are taken into account, but getting the entire group to achieve is the ultimate goal. One way to evaluate student achievement is to set baseline data. This was done using the pre- and post-test. The results were examined using the rich descriptors of qualitative analysis. The overriding concern was that all the students were getting a quality mathematics program for the summer. When students did fail, or did not progress, detailed explanations were provided through weekly

evaluations to the Rise Up staff as to the nature of the backsliding and correct actions taken, and other plans that were in place to ensure success of all the students.

Cultural Competence

Ladson-Billings describes the parameters demonstrating cultural competence as teachers who "support the home and community cultures of students while helping students become proficient in the cultures of schooling and education" (1998, p. 261). The first step toward this competence is that white teachers recognize that they too have a culture as well as their students of color. This helps these teachers to stop seeing their students as "other" and therefore deficient. In addition, "culturally relevant teachers know when to introduce relevant examples from their students' backgrounds and experiences to make learning more meaningful" (Ladson-Billings, 1998, p. 261). Lastly, culturally competent teachers allow the students to use their own "language" in the classroom but also teach them to use Standard English, or in the case of this research, the accepted language of mathematics. Another aspect of culturally competent teachers is the willingness to get involved with the community in some way. This was achieved in the project by attending orientation, Parent night, and the "Graduation" ceremony.

Sociopolitical Competence

Sociopolitical competence goes beyond critical thinking, which in most classrooms is "a set of prescriptive steps and practices that may reflect important processes but that are attached to relatively inane content" (Ladson-Billings, 1998, p. 262). Sociopolitcal competence includes civic awareness and activism. How is this achieved in a classroom where calculus is taught? The involvement of real world problems such as unemployment, or the esoteric realm of GDP and economic indicators,

the impact of such abstract ideas on my students' parents are all ways to raise the consciousness of the students.

CHAPTER 4

DISCUSSION

The premise of this action research project was to teach a small portion of the differential calculus to a group of African American urban students during a six-week college preparatory summer academy. This premise provided the framework then, to examine all aspects of the interactions that took place inside and outside the classroom. These interactions included those that took place between the instructor and students, instructor and parents, and the instructor and other Rise Up staff. The scope of these interactions runs the gamut from lesson preparation, to attitudes of the students, the past history of the students (gleaned from their mathematical biographies), classroom dialogue and audio recorded conversations with students. This analysis also includes data gleaned from my personal reflections and field notes, reflections on family night, and the pre-/post-test scores on a mathematics exam. Lastly, an exit questionnaire that was given to the students during the last week of the session and a qualitative synopsis of the results is provided at the end of this chapter.

This analysis was guided by the broad theoretical conceptions of the teacher assuming the role of "Tribal Elder." This emerging theory implies that the Tribal Elder teacher becomes more than a teacher or a mentor; teaching as a Tribal Elder runs deeper than that. Teaching as a Tribal Elder means the teacher immerses him or herself in the culture of the students. The Tribal Elder teacher learns and at times adopts the students' patterns of speech, but at the same time demands that students adopt the formal register of mathematical language. The Tribal Elder teacher allows for the lines of authority in the classroom to become circular instead of linear. A "circular" classroom is more

relaxed and less formal. The students work in self-selected cooperative groups and engage in dialogue that may or may not have anything to do with mathematics. Even when the students are talking and not working on mathematics, they are building community and the classroom is becoming a family. While the students are building their community, the Tribal Elder teacher is listening ("ear hustling") to the students. In this way the Tribal Elder teacher learns cultural cues, speech patterns, and finds out what is happening to the students that is important to them. This information can then be used to put the instruction in context for them. As part of this community/family building, the Tribal Elder teacher seeks opportunities to engage with students outside of class and meet their parents in non-confrontational ways; such as at church, or at a school family night where the emphasis is on meeting each other outside the roles of "teacher of Kendra" and "mother of Kendra" and in the roles of two adults meeting in a social setting. Lastly the Tribal Elder teacher recognizes that the achievement of the group as a whole takes precedent over individual achievement; or as my students would say, "we aren't moving on until everybody gets it."

The above list is not exhaustive and in fact, to come up with a prescriptive, by-the-numbers method of teaching runs counter to the epistemological stance of critical theory and an ethnomathematician. I find such "how to laundry lists" demeaning to the teaching profession and insulting to me personally. In addition, research has shown that the current European structure of the classroom is foreign and even hostile to our marginalized students of color and makes them uncomfortable (Hilliard, 1994; Ladson-Billings, 2006). The current norms of the classroom focus on the achievement of the individual over that of the group. Teachers, students, and parents each have a defined

role, which places them neatly within a linear hierarchy in this structure. Government and corporate interests determine most curricula, which places the emphasis on maintaining the United States' edge in the global economy. This type of schooling is good at producing compliant factory workers, but places little emphasis on the creative and intellectual development of our children, nor does such schooling provide an emancipatory or liberatory experience for children of color (Martin, 2009).

What the Tribal Elder teacher does is break down the current structure of public schooling and creates a family—or more accurately a "tribe"—within the classroom that eschews the hegemonic norms of competitive individualism and seeks to replace this structure with a more collaborative space where the culture of the students' is not only valued, but becomes the foundation of a new classroom structure. This can have adverse consequences or ramifications for the Tribal Elder teacher. These adverse consequences could range from a reprimand from the principal for not following the curriculum, to outright dismissal for violating school policy. This is why it is imperative for the Tribal Elder teacher to be the "expert" in his or her subject area and to keep the lines of communication open with the building principal. In my experience I have found most building principals are reasonable people. As long as they "see" learning taking place in a classroom and the children engaged in high-level mathematics, they give the teacher a wide berth on how they conduct their class.

In this chapter, each of the emerging themes of Tribal Elder teaching is explored through the emerging themes of Tribal Elder. I initially developed analytic codes for my data using open coding. I then reread the data using focused coding in order to group codes and infer connections among them. From this iterative process, I induced key

analytic and explanatory themes that guided my subsequent readings and interpretations of the data. I looked for patterns and relationships that emerged, and these patterns guided me to search for other connections and interrelationships. These formed the basis of the subsequent analysis. The themes that emerged are listed in the subheadings of this chapter. Themes expressed by the students are: High self-esteem and confidence toward mathematics; Negative mathematical experiences; Negative experiences turned around by a caring teacher; "Everybody gets it" and "breaking it down". Themes of the teacher researcher fell under the broad category of *Actions of the Tribal Elder Teacher* which are Circular lines of authority and Tiffany and Essence. As will be shown below, these themes fall under the broad category of establishing relationships in the classroom.

While I do not come to conclusions in this chapter, I provide through the voices of the participants, my interpretation of the data through vignettes so that the reader may arrive at her/his personal views on the teacher as the Tribal Elder in the classroom.

Overall Pedagogy, Curriculum Used, and Mathematics Objectives

> *Education…cannot focus on the mere transmission of obsolete content, for the most part uninteresting and useless, and inconsequential for the construction of a new society. What we can do for our children is offer them the communicative, analytic, and material instruments for them to live with a capacity for criticism in a multicultural society impregnated with technology.* Ubiratan D'Ambrosio

The above quote is from D'Ambrosio's *Ethnomathematics: The Link between Traditions and Modernity* (p.29) and formed the foundation of my curriculum development for the Rise Up Summer Academy. The intent of the curriculum was to engage the students in a rich mathematical experience where the mathematics is both relevant to their lives and challenging. One aspect of the Summer Academy was that I

had complete autonomy in what I taught the students. Not only did this provide me the freedom to decide what I taught, this freedom allowed the students to set the pace of the course. Each teacher was responsible for submitting a course plan to the Rise Up Director. Below is an excerpt from the introduction to the course curriculum I wrote:

> The summer mathematics curriculum will consist of three parts: 1) Intensive algebra review through the study of calculus, 2) Teaching mathematics for social justice, 3) they will have one project (quick one) where they will look up one famous African American mathematician and give a quick synopsis of that person's life and the mathematics they "discovered[1].

This proved to be overly ambitious with only parts 1) and 2) actually happening, and very little of part 2) at that. In previous summers, I have assigned a research project for the students to investigate famous African American mathematicians, but this past summer we were so engaged in doing the calculus unit, that I made the decision not to add the research project.

I developed the curriculum using only my old calculus textbook from college. The teaching of functions (linear, polynomial, and exponential) and how they change in relation to the independent variable was the focus of the first two weeks of the summer. This provided a challenging backdrop for the students to learn the beginnings of differential calculus while reviewing their algebra skills. The curriculum during last two weeks was focused on polynomial functions and infinitesimal changes in the dependent variable. This was how we came to look at the rate of change of a function. With this understanding, the students then took the first and second derivative of a polynomial

[1] Benjamin Banneker is NOT ALLOWED for this assignment. There were many others, they are just buried in all those dead white guys the kids are forced to learn about in school.

function. The lessons are listed in Appendix G and the Curriculum Overview is in Appendix E.

One might come to the conclusion, upon a quick glance, that the lessons and the overall unit seems rather "cookbook" and that procedure and the use of algorithms takes precedence over discovery and exploration. Another criticism might be that the unit is very teacher dominated, with the students having little say in the design of the course. This second shortfall, one could argue, runs counter to the Freirean concept of teaching for liberation (Frankenstein, 1997). Some may claim, that as the white teacher of urban African American youth, I am oppressing them through this hegemonic curriculum. And lastly, a third criticism could be, where is the ethnomathematics?

I would have to agree at first blush that all three criticisms have merit. While making the lesson plans, I continuously thought about D'Ambrosio and what he was trying to get us to do with our students by not teaching them "dead" mathematics. D'Ambrosio challenges teachers to teach new and exciting mathematics (fractals? cloud computing? the mathematics behind animation?). When my students study algebra back at their home schools is this dead mathematics?[2]

I made the decision as a teacher and as one with an epistemological orientation towards the ethnomathematics paradigm, that calculus was not "dead" mathematics. Rather navigating the students through a difficult introduction to calculus, a course many thought they would never be able to do—or some had never heard of, was actually teaching them to navigate the world outside. Thus the curriculum provided a framework

[2] This is a discussion for another research project. But in my opinion, no, algebra is not dead mathematics. It's just that too often we use "zombie" teaching methods.

just described for Tribal Elder teaching to take place. This thought I kept in the back of my mind the entire time I was planning the course and during implementation. I also believe that when introduced to a new field of study, much of the instruction comes from the instructor and in mathematics and physics, scaffolding by the instructor and having the instructor "model" certain processes in solving problems is essential at the beginning. I liken this to an apprenticeship period. As the students get more comfortable with the subject matter, then they move from being an apprentice, to adopting the subject as their own and feeling comfortable trying several methods to problem solve.

But where is the ethnomathematics? First ethnomathematics is a new field of mathematics that is still being defined by its founding experts. Is ethnomathematics a pedagogical paradigm, or is it subject driven? The answer is "both/and" making ethnomathematics a two-sided coin. One side of ethnomathematics looks at the mathematics practiced by certain cultures. That's not the ethnomathematics lens discussed in this research project. In this research project, and why calculus was selected, is the underlying Freirean notion that all cultures have intellectual value to add to the knowledge of the human condition. In addition, the oppressed culture needs an opportunity to learn the ways of the dominant culture. And the instruction needed—especially if you are the instructor from the dominant culture—should incorporate and value the knowledge the students from outside the dominant culture bring. The instructor should recognize that the students possess the innate ability to learn high mathematics. I believed these students had the knowledge and ability to grasp calculus, whereas for many African American urban youth their schools tacitly accept the

worldview they are not capable[3]. This means that by teaching calculus, I was teaching for uplift and liberation. Once again I was teaching those that have been oppressed how to navigate their world. I also wanted to instill an excitement for mathematics. Few things in life are more motivating and rewarding than succeeding at some endeavor others see as too difficult. That is not teaching "dead" mathematics, but teaching pure mathematics at the highest level.

Mathematical Stories of the Students

Having established the reason for the curriculum and how the choice of teaching calculus fits into the Tribal Elder framework, the next portion of this analysis examines the "mathematical stories" of the students. These stories come from the student mathematical autobiographies written during the first week of the Summer Academy. One aspect of Tribal Elder teaching is to know your students. Lipka (2005) wrote that one aspect of the Tribal Elder is that they are "kin." By using the mathematical biographies, I got to know the students' mathematical history. I knew some of their great experiences as well as some that were horrific. A secondary reason for the mathematical biographies was to see if these urban African American students, who had college aspirations, fit the oppositional model to mathematics that many of their teachers believe they possess (Ogbu, 1998).

High Self-esteem and Confidence Towards Mathematics

Twenty-seven. Out of thirty-two mathematical autobiographies that were turned in, that was the number of students who self-reported a sense of high confidence and high

[3] Only two urban high schools in the Kansas City area at the time of this writing offer calculus.

self-esteem in their mathematical abilities. This seems to run counter to the conventional wisdom of the literature (Leonard, 2008; Ogbu, 2004) and of the general attitude of the public about African American children and their mathematical ability. That was not the case with many of these students. Now, within the same autobiography, a very negative mathematical experience can appear, but it is followed almost immediately by overwhelming positive experiences that these students had in mathematics class. Most of the bad experiences had more to do with teacher relationships than with mathematics as a subject area.

Many of these positive experiences began at a young age as Eugenia[4] writes while answering the question about when she first realized she was good in mathematics:

> I had first started to realize I was good at math was when I had started getting good grades, and having better understanding of my numbers and variables. I was in 3rd grade when I realized that I loved math. I was studying my timetables. I also found out I was good at math was when my friend had needed help, and I had the desire to help her and I had asked the teacher was it right and then the work was correct. (Eugenia)

Being a good math student also increased Eugenia's self-esteem as evidenced when she writes, "I had felt smart, in a higher grade, and real good inside that for once I didn't feel stupid like other people."

Brittainy also has a high opinion of her mathematical abilities when she writes:

> I've had countless experiences in math which I've felt to be my best experiences in math class. However, I do remember the first one I can remember when I was in first grade. As a class we were asked to draw bar graphs and I was the only student to have done the assignment correctly without help.
>
> This is when I thought math was the easiest thing on Earth. Everyday I was eager to learn more about math. I even remember where I had been sitting when my teacher announced to the class how well I had done. I felt like I was the smartest

[4] All names of students are pseudonyms.

> student of all time! Since that day, I've had many experiences in math, which I've felt the same way. (Brittainy)

We see again that Brittainy had a very positive experience at an early age, this time in the first grade. Her eagerness to learn new mathematics carried with her into the summer I taught her, when she was a "rising sophomore."

Three of my strongest mathematics students were Roxanne, Deonica, and Charlene. The confidence they exuded toward math class each day in class is reflected in their self-reporting of high self-esteem for doing mathematics. Roxanne writes that, "Yes I have always been comfortable in math class. I like [that] I'm advanced in it." Deonica shows the same level of confidence by writing:

> As an 8th grader, taking algebra made me feel really intelligent. So always wanted to learn more math to stay ahead of everyone else.
> My friends always knew I was smart before I even took algebra but now I feel like I really get acknowledged now and are willing to ask for my help." (Deonica)

Charlene who was the oldest student at the Summer Academy (she was the only one that was going to be a senior) wrote about her mathematical abilities this way:

> I first recognized that I was good at math when I was in the 4th grade.
> In class I used to enjoy going to the board to do work and all my friends used to come to me for help. And still do.
> I felt very confident about myself. I felt confidant because I wasn't struggling like everybody else. Next to feeling confidant I felt smart. (Charlene)

Charlene also displayed her maturity and self-confidence by showing a little humility and laughing at herself when she wrote, "I felt smart because I was one of the class geeks." In this instance, Charlene is wearing the "geek" mantle with pride.

The girls I've illustrated centered their mathematics abilities around themselves and their general "smartness." They spoke highly of teachers they enjoyed, but as we can

see from the above examples, they had a tendency to attribute their math prowess to their own abilities, whereas the boys as we will see, seemed to place a greater emphasis for their abilities on the teacher. When we look at the boys who wrote positively about their mathematics experiences, they wrote about how it was the teacher that had the most influence on their mathematical ability.

Brandon, a rising sophomore who wants to be an engineer and really understands the mathematics that is involved in that career field, writes:

> I first realized I was good at math ever since I was in 9th grade. I had a real good teacher named Mrs. B. She was very interactive and made equations and solving problems very easy to understand. Mrs. B. taught us algebra 1.
>
> Everyone in her class passed and enjoyed coming in.
> After taking her class, I felt way smarter and superior in math. (Brandon)

Notice how Brandon cares about the instruction and how he *feels* "way smarter" after Mrs. B's class and not before. Marcellus, a rising freshman male student, also writes about the importance of connecting with the teacher:

> I first learned I was good at math this year in Miss J.'s algebra one class. I knew I was good in math, because I learned things the first time it was taught. Everything felt natural. I just zipped through all the work and since I was done before all my classmates, Miss J. taught me shortcuts and other things that weren't in the required curriculum. (Marcellus)

Marcellus has high confidence in his mathematical abilities, but like Brandon and several of the boy students, he attributes as much of his success to the teacher as to himself. Notice too that the boys' successful experience happened around their 8th and 9th grade years which is later in their school career than when the girls self-reported their best experiences happening around third or even first grade. This difference in sexes for when the good experiences began was repeated in all the math autobiographies.

Many of the stories ran counter to the conventional wisdom held by many teachers who teach in the urban core that African American students don't like mathematics and have very little interest. Upon first entering the classroom, the Tribal Elder teacher assumes all the students enjoy mathematics and understands there may have been some unpleasant experiences along the way for some of the students, but the reality is they enjoy learning and they enjoy learning mathematics.

Negative Experiences

Not all the experiences of the students were positive. Some of the students struggled and hated math. An emerging theme from the students' biographies and from the audio recorded sessions was the negative math experiences centered around access to the teacher. Only two students out of the thirty-one autobiographies mentioned that math was too difficult. The perception the students who struggled seemed to have was that they were struggling, not because of the math, but because the teacher became unavailable to the students.

Asaad is a rising junior whose parents are refugees from Somalia. His English is impeccable and he was an excellent student. Asaad was very quiet in class, but it wasn't because he was bashful. He was quiet because he was always observing everyone and everything that was going on in the classroom. Asaad writes of his math experience:

> Every math class I ever attended seemed pretty easy at first, but after the first month, the teacher helps the students less and less. Without the teacher assisting me, I tend to give up and fail the class. I remember in 6th grade, the teacher refused to help me. I gave up. I almost failed that class. (Asaad)

But once Asaad got the help he needed, math class became very easy, though he still claims he has trouble with long division.

> My best experience in math was when I was failing math. My 5th grade teacher told me to stay after school. Ms. Anderson assisted me with the part I didn't get. The problem was division. Division was hard for me because I was never taught how to properly divide.
>
> So throughout my fifth grade year, after Ms. Anderson helped me, I had no problem after that. But I still struggle with long division. (Asaad)

That Asaad still thinks he struggles with long division shows just how long these negative experiences in math class can last. To see if Asaad still struggled with long division, I jokingly gave him some problems to do. I told him he didn't have to do them if he didn't want to. But I just wanted to see if he had trouble with long division. He did the problems easily and grinned sheepishly. When he finished, I said, "I didn't think someone who could find the roots of a quadratic without a graphing calculator would have trouble with long division."

Kendra and I just seemed to hit it off from three summers ago which was my first experience with the Rise Up Summer Academy. She was a good dancer and attended a magnet fine arts high school for dance. I did not know that she had struggled in math class. She did well on the pre-test that first summer and with her no nonsense attitude towards schooling, I made the assumption she was good in math class. Every summer she performed well for me, so I was a little taken aback by her struggles. Like Asaad, Kendra had a similar story about not having access to the teacher, but her situation did not improve as she writes:

> I am not great at math and this past school year (junior) has caused me to dislike math because I had a horrible teacher who could not teach for anything. She didn't even try to teach.
>
> She just sat behind her desk and complained about her job. She never, and I mean never, showed us anything on the board and if she did she whipped through the lesson like we were a school for gifted children. (Kendra)

Kendra's situation did have a positive experience in her 6th grade class and, I guess, in my class during the summer academy, when she writes:

> My best math experience was when I had the best math teacher ever. I had this teacher in 6th grade and before then I hated math. This experience made me want to learn math more because the teacher had made it easy for me.
>
> Another teacher that has done this is Professor Riggs and I am not trying to suck up, this is just the truth. (Kendra)

After I read Kendra's math autobiography, I talked with her about why she liked my class in the summer. She said it was because, "You actually teach. You just don't put a bunch of stuff on the board and then sit down. You actually teach." (Field Notes, Jul 10)

Many times with students' comments you need to add some perspective. It may not be as bad, or as good as they say. But, I have seen this phenomenon of the teacher just putting an assignment on the chalkboard, the steps for how to do the problem are either given as a worksheet, or written on the board prior to the students coming to class. When the students then come in to class, no instruction is given, just time to do the posted assignment. In this way, the teacher can make a hollow claim that they have "presented the material," and it is up to the students to learn. When you give that teacher an incredulous look, they quickly add, "If they get stuck, all they have to do is ask for help."

One of my questions I would then ask was, "Do you grade the kids' work." (I already knew the answer, the kids had told me "no.") This would give me an opportunity to teach the teacher, by advising them that if they would grade the work, the kids might feel compelled to do it and actually ask for help. It would at least be a start.

This is lifer/quitter teacher at its worst. This is how a teacher can be unavailable, yet be in the same room. When pressed even further about their methods, the lifer/quitter will claim "they just don't want to learn" as the catch all reason behind the bad pedagogy. This happened in all three of the urban high schools where I taught. The Tribal Elder teacher, besides not spending any more time with such a teacher, makes her/himself available to the students on all levels. These levels just don't incorporate the mathematics lesson. But you are available by listening to their stories, and knowing what is going on in the students' lives.

The final claim of the lifer/quitter that "these kids just don't want to learn" is refuted by my personal experiences at the high schools. In my last high school, which was an alternative charter school, students—mostly male—would show up at my door asking to come in. I would ask them what class they were supposed to be in, and it was usually gym, or a class where no direct instruction is taking place. "Okay," I'd always tell them, "but you're going to do the work. I just don't want you coming in here to clown." They would nod, come in, and for many it was the first time in a long time, someone actually taught them math, and they got it!

Chihara was a quiet student who struggled in math and in her other subjects. I make this observation based on teaching her for three summers and her writing samples. She needed and received extra help in most of her Summer Academy classes, yet I suspected, because of her quiet personality, that she was probably not asking for help in the regular school. In her autobiography she writes about how the Benchmark system was very hard for her because it was all testing. She writes about how every time she takes a test she goes "blank." Again, we have a teacher who writes the math on the board

with little or no explanation and is done with the lesson. This teacher then was not only unavailable, she sent Chihara to another to teacher to get help. However, Chihara's situation improved after a caring teacher "pushed her hard" even when she wanted to quit. She also wrote about how she liked my math class because I was funny.

> Benchmark you have to have two passes to pass one benchmark. I did not pass very many Benchmarks. When I first realize I was really bad at math was when I helped someone or I took a test. It all goes blank. I felt real dumb and did not see the point in learning no more. I made myself feel like I was bad at math. And I always felt bad in math.
>
> Mr. T was the best math teacher because he pushed me even when I wanted to quit and give up. Mr. Riggs is also the best teacher because he's funny and makes it fun. (Chihara)
>
> One thing I did not like about Mr. T is he said I was scatter brained and I did not like that, but it was true.
>
> I like math, but not when it gets hard. I hate that because it don't stick in my head. (Chihara)

Chihara spoke of a teacher not being available to her when she was seeking help on her geometry. The teacher sent her away, but luckily she found another Tribal Elder in the school. The below excerpt is from an audio recorded interview taken on the second to the last day of the Academy when we were talking about what math class she was going to take at her charter school the next year:

> Mr. Riggs: Okay...but I also thought they taught like..like what math are you going to take next year?
>
> Chihara: Geometry...no...(laughs) I took that this year,,,or last year..um...algebra two,
>
> Mr. Riggs: Okay, so they've got the regular curriculum there. You're taking algebra two. How do you feel about taking algebra two?

Chihara: I mean its a little scary because I barely got geometry. I got it, but I barely got it. And me not liking math and me and math don't click, so...it's kind of hard.

Mr. Riggs: What do you want the teacher to do?
Chihara: Teach. Help me.

Mr. Riggs: Did you get help last year in geometry?
Chihara: Some...but it was kinda hard because people was talkin' and she like...she wanted us...she just threw like paperwork out at us and like actually didn't sit down say what this is and this is what this is. She did a little bit, but not a lot. So enough to where I would get it but then I'd ask a question and she'd get frustrated 'cause I asked question.

Mr. Riggs: Because she'd say she just did it on the board?
Chihara: Yeah...and she didn't wanna take that extra time to help.
Mr. Riggs: Oh, so she would give you that opportunity to get extra time to help?
Chihara: No.

Mr. Riggs: Would she say come see me during your study hall or seminar? Did you all have seminar?
Chihara: She told me to go to a different class...a different teacher.

Mr. Riggs: So you weren't ready for geometry? So you got put in a different class?
Chihara: No she like...um...she like... um I asked her about her lunch period, because her lunch period was my lunch period as well...and I was like can I stay after school or work with you on our lunch period and she said no, but go ask Mr. um...I forget...Mr. N. Mr. N was a really good teacher, I wish he was my teacher.

Mr. Riggs: Did he help you?
Chihara: Yes he helped me a lot.
Mr. Riggs: And you weren't even his student?
Chihara: yeah.
Mr. Riggs: Really! That is pretty good help.
Chihara: That's pretty much it. (Recording, July 28)

Negative Experiences Turned Around By a Caring Teacher

From Chihara's last words, the reader can see what a difference a caring teacher can make, and how devastating a teacher who doesn't make the time can be. In this next set of stories students relate how a caring teacher changed their negative disposition

towards mathematics. Some of students tell of teachers who were funny—humor always seemed to play a big part—and some tell of teachers who pushed them hard and would not let them fail. DeMarco's football coach, who also happened to be his algebra teacher, related algebra to football. This didn't occur in the classroom but out on the practice field.

> It could be confusing but it was kind of fun. When I learned how to do it, my teacher used football as an example. My algebra teacher is my football coach.
>
> The way he used football was by pulling lineman. Last year I was guard, so I was familiar with what he was talking about. What is funny is that he brought it up in practice that day. (DeMarco)

This next story comes from Jeremy. I first met Jeremy three years ago during the first summer I taught at the Summer Academy. Jeremy was fourteen, a little on the small side at that time, ornery, didn't really want to be in the program too much, and dared me to teach him. I liked him right away. I had Jeremy the first thing in the morning during that first summer. Those mornings he usually was asleep when I came in the room, and as class started and the others were participating, he would just go through the motions of doing the mathematics after much prodding from me. After the third week of that summer, Jeremy was no longer in my class. I found out at the staff meeting that Jeremy had got into trouble at the campus bookstore so he was temporarily kicked out of the program. The Academic Coordinator and I both knew Jeremy stole from the bookstore trying to get caught so he would get kicked out of the program. This all happened before Jeremy was to start his freshman year.

A curious thing happened to Jeremy during that freshman year though; he grew up. Not only had he grown in stature—the next summer he had a muscular, athletic build

he now carried on a six foot frame—but he had matured. By the third summer, which was the summer this study was conducted, he was one of the *student* Tribal Elders in the class. Below are excerpts from Jeremy's mathematical autobiography and they reveal what a difference a teacher made in his life, and how poetically these kids can write about those who have reached out to them in some way.

> The best math teacher I ever had was here and her name was Ms. P.
> She was so nice if she were an angel she will make the whole world laugh and smile.
>
> I mean she basically have you sittin' down in front while she explain everything that went down in the problem. And plus if you was struggling she would tell you to come after school for extra help.
> It was a good experience because I wanted to learn more and my teacher made it seem easy by everything needs a formula.
>
> Like for a line/slope problem you can use y = mx + b to solve for them problems and others.
>
> Once my friends seen me fly through my math problems.
>
> I just thought to myself I'm good.
>
> Then they were asking me to help them with their homework tutoring and stuff.
>
> So I thank my teacher for breaking it down and summing it up in one or two sentences. (Jeremy)

However, as we see in the same biography, Jeremy's confidence in math class is fragile. This incident happened a year after he had the teacher he described as "an angel who could make the whole world smile." It didn't take much for him to shut down as he writes:

> It was a Friday afternoon and the last class of the day. I was feeling happy because we were learning to do two-step equations.
> So the teacher asked, "Where does the variable start?"
>
> And so I raised my hand and said on the left and she said correct.

And then she asked, "What is 5 times 3?"

> And I said 20 and everyone was laughing at me. So I felt slow and mad and so I just went to sleep. So I thought to myself that I hate math. So that was basically the reason I hate math. (Jeremy)

When I read the above from Jeremy, I thought of the many times in my own class when I've seen students who I thought were doing just fine, when all of sudden they tune out and go to sleep. This is where those circular lines of authority that occur in the Tribal Elder classroom may remedy or, prevent such an occurrence of a student shutting down in class. When Jeremy misspoke and said that 5 times three was 20, the teacher might have laughed with the other students. That's okay, but then immediately the teacher needs to put her/himself in Jeremy's position and say, "I make mistakes like that all the time. I know you meant fifteen." In a circular classroom, the Tribal Elder teacher has enough confidence in himself or herself that he or she allows the students to see him or her make mistakes. The Tribal Elder also apologizes to students when they have been wrong about something that happened in class. This is not showing weakness, but strength, and a Tribal Elder teacher must be strong for their students. As a Tribal Elder teacher, you can never forget that lives are at stake.

The last student story to highlight a positive experience with a teacher that changed a student's disposition towards math, comes from Eric. Eric is a rising freshman who at first thought he wasn't very good at math. But as shown by his mathematics autobiography, he was anticipating working with me that summer. I assigned the autobiography after the first week of class,

> No I never really felt comfortable in math because I thought I was gonna fail and never succeed it was never my favorite subject. My best experience in math was finding out about calculus and where it originated.

> Calculus is the field of mathematics where we study the instantaneous rate of change of a function. The two different types of function (calculus) are differential and integral calculus. (Eric)

> It is a good experience because it's going to help me through college, high school, and the rest of my life. Yes this experience makes me want to learn more in math. My friends reacted but were shocked I'm learning and know how to do this stuff. The teacher kept teaching me and made me understand more that is why it was such a great experience from a teacher's perspective. (Eric)

I hold this up as another example of African American high school students having a strong desire to learn higher mathematics. Even though Eric confessed to not being very good at math, and that he thought he was going to fail, within a few days he realized that he could do it. He also had no qualms about telling his friends about what he was learning and how it made him feel good, and his friends seemed to support him. Eric's case again runs counter to the conventional wisdom held that African American high school students are oppositional when it comes to learning math.

"Not until Everybody Gets It" and "Breaking it Down"

Two teaching methods that students mentioned in their math autobiographies and in our conversations in class was the concept of "everybody gets it" before moving on, and "breaking it down." One characteristic of a good teacher many of the students commented on, was a teacher who didn't go on until "everybody got it." This makes another connection to "teacher availability" that the students find so important. The students want to know the teacher is there for them.

During one of the recorded interviews I asked them if it was important that everybody "got it" before they moved on in math class. Both classes answered with a resounding "Yes!" In the first class, Asaad said it was "very important."

Kirby spoke up and said, "Uh, then it's important because if everybody don't get it, then when we go on to the next step, they gonna be asking questions, and it will be slowing us down, plus they won't be getting the education they need." (Recording, July 15).

In Kirby's comment, one can detect that sense of community among the students in the class that is so important. I asked him, teasingly, if he was concerned about the education of the young lady, LaToya, sitting next to him? "Well, yeah," Kirby answered. Then I asked LaToya if she was concerned about Kirby's education. She blushed a little but nodded in the affirmative. I felt like a heel for asking my question of Kirby in a less than respectful manner. The sense of community and looking out for one another is very strong among these students, and I should have known better.

In the second class I asked the same thing and the scene repeated itself. One student, Marcellus, even took the notion a step farther when he started explaining how the benchmark system was leaving a lot of students behind. The Benchmark system rewards individual effort only and there is no place for collaboration. Once you pass your benchmark, you move on and your friend is left behind. Having a benchmark system is an example where the school environment is hostile to African American students. The Benchmark system runs counter to the socialization of African American students and what the African American community wants for its children's education (Perry, 2004b). The irony is that the only districts that use the Benchmark system in the Kansas City area, are those districts that have predominantly African American students. The following is an excerpt from the conversation that took place that morning after the class:

Eugenia: There is no child...somethin'...No Child Gets Left behind

Mr. Riggs: Right Yes. What about No Child Left Behind?

Eugenia: But they don't care about that.
Marcellus: They don't.

Mr. Riggs: So what about NCLB, Eugenia?

Eugenia: You know what I'm saying, it's like we was just talking about, like the teacher don't move on until like everybody gets it, that's the whole district phrase. They don't really do it.

Mr. Riggs: Yeah that No child left behind? It's just a phrase?

Eugenia: Uh-huh. Yeah.

Mr. Riggs: Yes, Marcellus…

Marcellus: This is how it go down. So you're talkin' about no child left behind right? Tell me why the Central 8th graders, only like 40% of them is going to be 9th graders. Everybody is going to be in the same grade next year right? So what are they talkn' about, No Child Left Behind? When 60% of them are gonna get left behind. While we be in class, they don't be caring, teachers don't be caring, they just teach us what we need to know. And then we go on to the next grade and all these people stay in the same grade.

Mr. Riggs: So what's your telling me...let's say out of 100 or so..

Marcellus: We only have about 212 8th graders..

Mr. Riggs: So you're saying that only 60 of them are going onto 9th grade?

Marcellus: No, only 40 percent.

Mr. Riggs: And the rest of them are going to stay at Central middle?

Marcellus: Uhhh...Either that or they're going to wind up going to or if they'd already been flunked, they got to go to that one school,
Mr. Riggs: You mean like Franklin Academy...

Asaad: Manuel
Mr. Riggs: Oh yeah, Manuel Tech.

Marcellus: Or they gonna hope their families get them on the home computer program or whatever.

Mr. Riggs: Oh really? So now for the kids who didn't get it, their solution is to leave them at home and give them a computer?

Marcellus: Or put'em in a middle school with a uniform and they're like 16 and they're in 9th grade...
Asaad: Are you serious?

Marcellus: I swear to God! (Recording, July 15)

It should be noted that these numbers used by Marcellus are probably not accurate statistics by any stretch. However, the perception that Marcellus's fellow students are getting cast aside in large numbers is very real to him. The failure rates of their fellow students are a very real concern to these students. I am going to make an assumption here that in the suburban schools the dropout rates and failures of students is not such a palpable concern among their student body. Very few suburban students know any dropouts so this phenomenon is much more abstract to them; for suburban students and their parents, failing school and dropping out is something that happens to those that are *other*. Failing school and dropping out does not have the school/streets, freedom/prison, and lastly life/death reality that it does to urban African American students. The Rise Up students who witness a high dropout rate among their peers, understand the dire consequences when teachers don't make sure "everybody gets it" before they go onto the next unit of instruction.

For the Tribal Elder teacher then, the idea of "everybody gets it" is not just a vacuous, poster-like phrase that sounds like a nice ideal, but is not really practical or possible, or even desired. The Tribal Elder teacher who is teaching for liberation and uplift, cannot accept or tolerate the lifer/quitter posture that we should not lose too much sleep over the one or two students who don't get it, and probably never will. The Tribal

Elder teacher must do just the opposite and teach as if the material you are teaching that day and whether or not the students get it, is a matter of life and death. You must teach that way, because it is a matter of life and death. The Tribal Elder teacher must make sure "everybody gets it and teach with a true sense of urgency.

An emerging theme from the math autobiographies was what the students want from their teacher is someone to "break it down." I heard that phrase many times during my years teaching in the city and I heard it and read it again this past summer. "Breaking it down" I have taken to mean, we start small and build. Lastly as Chanise wrote, "My second teacher at Southwest was on a very basic level. A lot of the things they taught me then was things that were being taught in 5th grade." Tribal Elders do not "teach down" to their students but rather teach up. (Field notes, July 21)

How does one teach with a sense of urgency and break things down? What does teaching with a sense of urgency look like? We heard from the voices of the students that what they want is a teacher who is available and understands them. One facet of how Tribal Elder teachers make themselves available is by changing the standard school structure of hierarchal lines of authority to circular lines of authority. This is done by engaging with students in one-on-one instruction, using humor, and allowing the students to freely interact with each other. Another facet is to employ methods of instruction where "everybody gets it" before you move on. The last facet analyzed in this chapter is engaging with the elders of the community.

Actions of the Tribal Elder Teacher

The above vignettes painted a picture of what the students expect out of their teachers and their realities of school. We have seen evidence of effective teaching and

ineffective teaching. One particularly great teacher, Miss J., the students brought up several times demonstrated all the attributes of a Tribal Elder teacher. She came to the students with the preconceived notion that they could learn. She taught them higher mathematics in spite of the crippling Benchmark System that was in place. She taught, as Haberman (2010) would say, "as if the students' lives depended on it." This teacher even went to the students homes on Saturdays, picked them up, then drove them to the local library for tutoring sessions. In this way, she stayed within the community the students knew; demonstrated that she was there for them; and made sure everybody got it before moving on. In this way she showed her commitment to the students and their learning, because through her actions she demonstrated that the she understood the stakes involved. (Field notes, July 5)

Circular Lines of Authority

On the second day of class, the students were given back their pre-test. The pre-test was designed for them to fail. The entire last set of problems dealt with calculus and I knew none of them had had any calculus. When I passed back the test I told them that they wouldn't feel bad. However, one thing that did give me pause was that several of the students had no idea how to plot points on the *xy*-coordinate axis. How the heck was I going to teach calculus, if we didn't have this rudimentary item down? One answer would be to review and teach the "essence" of calculus. I could just have them learn what the rate of change means, and how to apply it to the world. Then I re-examined the test. Due to my computer illiteracy, I had left the coordinate axis system off the test and asked the students to draw it in themselves when I passed out the pre-test. Very few of them had done that. I believed they knew how to plot the points, so the next day I gave

them a quick review of plotting points and most of them did it with little or no help. The test was flawed.

This one small incident led me to the idea that in teaching, relationships matter. Teacher knowledge of subject matters, and teachers ability to adjust on the fly and adapt matters. Lastly, teacher's attitude towards the students matters. All of these are culturally responsive teaching, which was defined in the literature review. To fix the problem of the flawed test, I needed to adjust on the fly.

Since most of the students did so poorly on plotting points, something I believed was the simplest thing on the pre-test, I decided we better review that. On the NCTM website I found a nice worksheet type exercise that would review graphing with the students. (The worksheet is located in Appendix G of the daily lessons.) I liked the lesson because though it dealt with graphing points, we had a chance to use the random integer generator on the calculator. We used this program to randomly generate numbers between one and ten, and then use these numbers as our x- and y- coordinates. It was worthy of note how the instruction of teaching the random generator played out in the class. The student reaction to the instruction and my reaction to them, demonstrates what circular lines of authority look like in the classroom.

Many of the students did not do the task with the calculator without assistance from me. They didn't even try. Was this learned helplessness, another one of the deficit theories used that claims African Americans can't or won't learn mathematics (Stinson, 2006)? Not at all. Of course the students weren't engaged when I was explaining because one of the shortcomings of the room is that it does not have a document reader so I could not display my calculator on a screen. So, all my instructions and demos are done

on my personal TI-84, which is hard for all the students to see at the same time. Students have two reactions when this sort of thing happens, they either ask a friend to explain it to them, or they stop listening, sit back and wait for a time for the teacher to come explain it. When I did finally get to a student, or usually a group of two students, I would ask them to show me how they got started and then we'd go from there. One problem others may see with this "bumble bee" method of going from student-to-student is that it is time consuming and it can be exhausting. Tribal Elder teaching is very high energy.[5] No sooner would I explain the procedure to one student, when the students sitting right next to those students, would ask for the same help. Again, is this learned helplessness? I don't think so. What I believe is happening is that they were building a relationship with me during this time. They were not being helpless and wanting me to do the work for them. The students wanted to know if I would invest in them before they would invest in my class. Was this time consuming? Yes. Was it important? I believe so. In my experience these types of days dwindle rapidly as the students develop confidence in you as the teacher and themselves as mathematicians. It should also be noted that at each stop with the students, I told them that the pre-test was "bootsy"—a hip-hop phrase meaning "messed up"—because I didn't put in the x-y-coordinate axis.

However, engaging in students this way runs counter to the conventional wisdom I used to hear in teachers' lounges and in professional development or even some methods courses which is: "Make the students do the work themselves. If you don't, they will always be asking for help and you don't have time to meet all their needs."

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[5] Possible follow-up research is investigating the "burn-out" rate of successful teachers in the urban core and how to prevent it.

First off, eventually the students did do the work themselves and it wasn't because I "made" them. They did the work because they were curious and wanted to learn math, and they wanted to please the teacher. But here is what can happen, if a teacher follows the mantra above: The teacher passes out the calculators. The students being naturally curious, start fiddling with the calculators and are not really listening, let alone following the teachers instructions. The teacher gets done explaining and immediately five or six hands go in the air asking for help. With an exasperated sigh—which the students pick up on—the teacher helps the first student, builds some rapport, and then moves along to the next student, who annoyingly—(if we're being completely honest with ourselves)—has the exact same question. Lather. Rinse. Repeat. By student four, the teacher is a little at wits end and doesn't really help that next student or the other two remaining ones. One reason is that by this time the other students are moving on to the next section and are asking about that. The teacher feels he or she must get back to "the-ones-who-were-paying-attention-in-the-first-place." So the teacher gives those students an abbreviated answer, or just quickly does it for them.

Either "gaffing them off" or doing it for them, solicits a negative response from the students. I've watched them sit back, fold their arms, and do what we teachers call "give up." Actually, they are just hurt (a glaring example of this is in both Jeremy's and Chihara's stories). They come into the class wanting to learn. But they also want to get to know you. You are the "wise elder" in the room. Especially if you're a teacher like me who has taught some of the students for three summers, the new students see you have a rapport with the older students, and they want to have that. When you give them

short shrift, their response is, "Well, it's just another white dude who thinks I'm dumb and not worth the time." (Field notes, June 30)

On the other hand, the teacher can have students who readily grasp the material, yet they want the teacher to come over and show them how to do it. This is what happened to me on this day. One student held up his hand and said, "Mr. Riggs, watch this and tell me if I'm doing this right." I believe this is classic, "look Ma, no hands" behavior. They want to "show-off" how smart they are. To deny your "children" that opportunity is unconscionable.

DeMarco quickly used the random generator and showed me his results. "Too feddy," I said. He cracked up along with the rest of the class. "Feddy", which sounds like "teddy", is an old Hip-Hop term where they have shortened the word "federal" meaning "big time." As in making a "federal case" out of something, or committing a "federal" crime. (Field notes, July 14)

Was this exhausting? Not really, I felt engaged with the students and that we were building a relationship resembling a Tribal Elder and the Apprentice. Also we were waiting until everybody got it and that's exciting.

The rest of the class periods went pretty much like above. Each day I made it a point to make sure that everybody got it. The difficulty of the material made that a little bit of a lofty goal at times, and many of the students did not "get it" everyday, but they all felt they were a part of the class. Evidence of this was in their math autobiographies and in the in the questionnaire to be discussed later.

I never have a preparatory set, board work, opening quiz, or anything like that to start my classes; at least not most days. I wait for the students to come in and say good

morning to each of them. That is if they are in the mood for a "good morning." Then I just start class. I had a high school student as a helper in the class. I had gotten to know "Joe" when he came out to visit the physics department of my university. We had a nice talk about his future plans—he is on his way to Michigan on a mathematics scholarship—and he was curious about my research. When I told Joe what I was planning for summer, he wanted to volunteer. It made for a nice dynamic in the class, having the "gifted" White student from an exclusive suburb mingling with Rise Up students. At first I was nervous, but I didn't need to be. Good kids regardless of background are decent to one another and Joe and the Rise Up students are good kids. While watching the give-n-take between the students and me for the first week, Joe said to me when leaving for the day, "I get it now. It's very different from what I'm used to but it works."

Part of the repartee that happens between the students and me is the joking around with each other. For some reason, DeMarco, Jeremy, and a few of the other boys thought I looked like George Bush. I don't see it, but they do. DeMarco is a big old bear of a kid who plays tackle on his high school football team. One day when I was passing the folders back that contain the students' work, DeMarco said, "Thanks, George." Without skipping a beat I said, "You're welcome, the Blindside."

The kids around DeMarco erupted in laughter. DeMarco smiled real big and said, "You got me, Mr. Riggs. I can't even say nothin' because I do play left tackle."

I knew DeMarco well enough to know that he could handle the joke. We also used the episode as a teachable moment with the class into critical thinking when examining how Hollywood portrays White Saviors all the time. Sometimes though things would go a little over the top. In fact Roxanne and Brittainy pointed this out to me

during one of the classes when things maybe got just a little too rowdy. It took me a minute to get the class down to a dull roar, and I was little upset. "Well you know Mr. Riggs, sometimes you bring it on yourself with all your jokes." "Umm-hmm, he do," Roxanne confirmed, without looking up from her work. (Field notes, July 14)

Part of becoming the Tribal Elder teacher is that as a white man from the suburbs, I am coming into their culture. It is unfair and unreasonable of me to ask them to change who they are to fit my teaching style. I need to adapt to their culture. One way I try and do this is by using their language and finding opportunities to use their language appropriately without sounding like a phony. For some this may prove difficult and may not be an appropriate intervention. The key is not being a "phony." Be real and let the students know what your culture is and give evidence at times, that you understand their culture.

Though I don't use any preparatory sets or other such "bell work" devices, I do have a pattern to my class. I write out by hand what I think are scaffolding type worksheets for the students to build knowledge during class. I think this practice came from ten years in alternative schools where textbooks were sometimes scarce. By about the second week of class, invariably a student will ask when they come in, "How many worksheets we got today, Mr. Riggs?"

I answer with a number that is plausible like 8 or 10, but unlikely. Usually this is followed by groan and shuffling off to the seat, with the student saying, "That's bootsy."

I answer, "I'm never bootsy, but sometimes I'm scandalous."

Other phrases used where I adapt to their culture are when somebody does something good, I'll say, "That was too feddy" or "that was tight" or "crispy." All of

these sayings when heard for the first time by the class are followed with squeals of laughter and expressions like, "Mr. Riggs, how do you know about feddy?" Then I'll once again tell them my background and reestablish "my street cred." I even had this written on their post-test, "Directions: Full disclosure—this test is designed for you to fail miserably on the first go around. (If you fail this test at the end of the summer, we're gonna scrap!)

Many of the students had not seen this little joke, but then giggles started around the room. Roxanne asked, "So we gonna scrap, Mr. Riggs?"

"Yep, yep, yep" I answered back.

"Really?" Roxanne said putting up her dukes, but grinning from ear-to-ear.

"You better sit down, baby girl. You don't know me," I said.

The class erupted in laughter. Roxanne, Charlene, and Brittainy started laughing. "I ain't never heard a teacher talk like that before," Roxanne said. "Where did you learn that?"

"I been around," I said. "I taught on the Avenue for five years. I learned things."

Roxanne and her friends nodded. My street credentials ("cred") had been established. They quickly got to work by themselves on the test. (Field notes Jun 30)

I noticed Roxanne when she first came into class. She walked in with that aura of confidence and I knew she was looking at this old white dude and wondering, "what is he going to teach me?" Or, "this is sure going to be boring." She was daring me to teach her something she didn't know. She didn't realize how easy she was going to make it for me, because she liked to learn and she enjoyed showing off how good she was in math.

As the days and weeks went by, Roxanne demonstrated that she was an excellent mathematician. Not only did she learn algorithms quickly, she also exhibited strong number sense. She quickly saw that when a denominator grows large, the term is quickly nearing zero. She grasped functions and finding the zeroes of a function and when that function might "blow up" (heading towards infinity). Roxanne did all this while still keeping her streetwise persona in tact. Yet at the same time, she sought validation from the teacher.

I gave this approval not so much overtly by praising her work in front of the others. I wrote notes on her work which she read immediately upon getting her folder. Sometimes these notes were a simple "good job!" or I would show her where she made a small mistake. Sometimes I even wrote bad rap ditties, which she shared with her friends and they laughed and groaned at the same time. One yardstick a teacher can use to know if they've reached Tribal Elder status is if a student says, "Mr. or Miss So-n-so is crazy." As far as Roxanne was concerned, I was a little crazy. (Field notes, July, 18)

She did want to "scrap" though at the end of the summer. We were at the end of summer celebration and I had not recommended her for an award. She flagged me down from across the room, pointed at me, then pointed at herself and mouthed, "We gonna scrap!" as she put up her fists like 15-year-old Ali, a broad smile spreading across her face.

I popped my collar at her to "shake the haters off"[6] and she laughed out loud and sat down with her mother. (Field notes, July 26)

Joseph was a solid, stocky kid blessed with a quick smile. However, he was not blessed with the math skills of Roxanne and her friends. In fact, Joseph was pretty far behind in his mathematics. He presented the challenge of how to teach him and at the same time keep the rest of the class busy. Remember, a Tribal Elder makes sure everybody gets it before moving on to the next thing. Some members of the class like Charlene, Brittainy, and Brandon were ready to fly through the lessons, I had to make sure Joseph (and his seat partner, Jarrod) didn't get left behind. By using the calculator I was able to teach Joseph how to navigate the mathematical world we were exploring. He had never worked with a graphing calculator before but once we got through the preliminaries, he enjoyed exploring some of the functions on his own and asking questions about them.

Joseph may have been behind in mathematics, but he was very far ahead with the gift of gab. I don't mean that he talked a lot in class, he didn't. He talked a lot to me, and he was always hustling some angle. I found it somewhat amusing how he had conned me for almost a week about getting his work done. He would make a big production of how he was not going to put it in his folder, but wanted to take it back to the dorm to work on it and he'd have it the next day. He knew I wasn't really listening. This is a case where I let my Tribal Elder instincts down. A Tribal Elder may get conned by a student, but a Tribal Elder should know that it is happening! I didn't. When I

[6] To "pop" ones collar at someone is usually in response to a threat, or in an insult offered by the one you are directing your collar popping. It literally means to "shake the haters" off which loosely translated means, "you don't scare or bother me."

finally called Joseph on it and asked to see his work over the past week, of course he had left the papers back in his dorm room or had lost them. We managed to get a few done. But getting the math worksheets finished wasn't how Joseph defined our relationship. (Field notes, July 22)

I always tell any class I teach a little about myself. I don't know why, oh sure I'm very proud of my Marine background and the kids are usually impressed and confused by that. Like many adults who get to know me, the Marine thing just doesn't fit squarely with the personality they see. Joseph had been in Marine JROTC the previous year and he had a grandpa and an uncle that were Marines. At the end of each class, before Joseph left he would show me some close order drill that he had learned the previous year. It wasn't good enough that I said, "That's pretty good, Joseph." No. Joseph knew that as a Marine, nobody ever did a drill move perfectly. The fingers weren't always curled properly, or you stepped off on the wrong foot, or you might have swayed too much when doing a "right face." He expected a critique. Plus he wanted to hear about places I had been. I knew he was not making up the story about his grandpa because Joseph said he was in the Korean War. That's too obscure of a conflict for a15-year-old to make up. Through this Marine tie-in, Joseph and I exchanged information about family. We were becoming kin.

Every morning Joseph came into my room with a hearty "good morning, Sir", a salute, followed by a fist bump. Then he would show me the latest drill move he had worked on. Each class ended the same way, except that he would say, "I'll have that work for you tomorrow." At the end of the third week, I finally said, "No you won't." He started to protest, but before an excuse came out, I asked him besides courage, what's

the most important thing a Marine has? He said sheepishly, "Integrity." Then he grinned, while his face twisted into a puzzled look, "You know Mr. Riggs, this calculus is too hard."

"Yes it is," I answered, then added "But you know what, I think you can do it."

Joseph just shrugged. The calculus he never really did get. But we were able to do some great catch-up work on finding the slope and equation of a line given two-points (the students taught me a far superior method for that than anything I had seen), and by the end of the summer we were finding the zeros of functions using the calculator. I knew Joseph and I had had a good summer when he said during the audio interview in the cafeteria, "Math should be easy next year."

One day, I finally had to put Marcellus out of class. He came in with that attitude of just daring me to deal with him. When I finally told him he had to go out of the room, he asked indignantly, "Are you putting me out? But you ain't even mad? You're actually telling me to leave?"

"I put it on my momma," I answered him.

"Oooh," the rest of the class said, then started laughing, as did Marcellus.

I told him, "And I'm also not mad. I just can't have you in here right now. That's all."

Tribal Elders never get mad at students. How can you when you're doing what's best for them and they are kin? Frustrated and exasperated are allowed. A little anger doesn't hurt because they need to see you're human. But getting mad? That is not allowed, yet it is the type of classroom many of them endured as evidenced by their mathematical biographies. Though I might use street language while talking to the kids, I

think it is very important to use formal register while teaching mathematics. (Field notes, July 21)

I always grade their work right away and write notes all over their assignments. Sometimes the notes are in the silly rap-ditties, sometimes they have nothing to do with the math, but have something to do with what is going on outside of class. But the kids read them and then share them with their fellow students. "Look at what Mr. Riggs wrote," they will say, unless of course, I wrote something a little more personal for them. Some examples are illustrated below (the notes in parenthesis were notes I made to myself on the students, or explanations of my feedback to the student):

> Riggs to Deonica: How did you get so smart? (Based on work of lesson 2) "Old School Deonica",, I love it! (she found the slopes of tangent lines by hand. Deonica is an excellent student who is also very confident and carries herself well. She is not afraid of being a nerd. In fact, I would be afraid of what she could do if she were called one!)
>
> Jarrod: (Wanted to be called Big Daddy Usher. Think he was just playing with me, but I went along. On one of his homework assignments I wrote:) "Big Daddy Usher, I lost you this week. Your behavior is good, but I need you to follow along in class." (Jarrod may have special needs, but he is very far behind-mathematically than the others.)
>
> Jarrod: "Jarrod, I'm going to have Joe (student helper) work with you." (Jarrod was not paying attention at all in class-it was way too hard, and he seemed to alienate himself from the others.
>
> Jarrod: "Jarrod, you tore it up today! Keep it up and let's write the answers down too."
> Kirby: "I need you working hard everyday, not just some days."
>
> Charlene Watson: "Hmmm…how significant are the significant digits?" Charlene was a top-flight student (rising senior) who could handle higher mathematics discussions and she enjoyed mathematics.
>
> Hammanda: (to me) "I don't understand none of this." (response) "Sorry we went too fast. No biggie. If we would have had more time, you have gotten it." (When we finally got to the calculus unit, Hammanda struggled. She struggled

for a lot of reasons-boy trouble during Upward Bound, the only Hispanic, thus she felt a little isolated.)

Roxanne: (She got a grading rap) "My girl Roxanne, does math as easy as swattin' a mos-keeta!" (Plus notes on how good she was,. At the graduation ceremony she jokingly threatened to scrap with me because she didn't get an award.)

Jeremy: "Jeremy, teach Marcellus when to clown, and when to work. You're doing great!" (Jeremy was exactly like Marcellus when he started the program two years ago. The Rise Up program believes in using peer-mentoring, as do I to help the more immature students succeed.)

I use other phrases like "ear hustlin'." The kids laugh at first then they get used to it, or they want me to say an entire phrase like, "Well I tilted old dudes 'Lac. Cruised the Spect with four…, five… dudes in my Cadillac" (old Tupac reference) "then we smashed out posted up at Crown Center to check out the breezies hangin' out 'round the fountain."

Octavia: (My dancer. I told her I was impressed with that and we talked about dance companies I've seen. To earn street cred I mentioned Alvin Ailey. That led to a long talk. All this during math class!)

Eugenia: "Who knew the girl had math skills?" (She could be a small drama queen at times and one time the boys were acting out a little. She tried working through it, though she herself had just had a bad day before.) "Much better today." I added, "I'll work harder at keeping the boys quiet so you can learn. That was my bad."

Takara: (Who now works at Einstein's on campus I wrote) "super!" (She doesn't believe she's good in math-last year she definitely saw no purpose in it. After doing particularly well I wrote,)"Are you sure you still don't like math?" Nope! She answered, closing her folder "I don't." "Ah, come on, Takara!" I said, laughing. She just grinned and shook her head. "Nope. I still don't like it."

Essence: My Muna Lee (Olympic track star from Central High.) I could tell by looking at Essence, she was an athlete. Our first summer together she didn't say two words to me. By our third, we were fast friends and she helped me with Summer. "Great work, your math and your mentoring of Summer." (There is vignette on Summer and Essence below.)

Parris: "This stuff is hard, good work!" They are used to getting a good score for "showing up"-Woody Allen grading system. I make them earn it. Smith Barney grading system. "Quiet, easy going, steady, Parris. Good work!" I also knew her

sister very well, MeiJoee. I think it is important that you let the students know that you recognize their personality, thus you are recognizing them.

Brandon: "Good work, Brandon! You have skills!" "Great work, but please leave Shaneka alone." (He grinned at that and shut his folder.)

Eric: Struggled at first. One of my rising freshmen. But then he got it and never looked back. "Got the hang of it, now he's tearing it up!"

Joseph: Wanted to learn. Felt embarrassed that he couldn't keep up. "Try and keep up, I know this hard and fast." ""Keep following along and do not be afraid to ask for help." "Okay, Joseph-I heard you today. I'll make sure Joe helps you along." But then we started having success especially when working with the calculator. "Fantastic work today! Keep it up! I knew you could do it."

It is hoped that the above examples illustrate how I try to build community with the students. Evidence that the students believed we were creating community were in their actions, comments during class, and things written in the math autobiographies. I'll never forget the highest compliment paid to me by a principal during an observation, "Bob, if you told those kids to follow you as you jumped out of the window, they would. I've never seen anything like it."

Until now, we have looked at the students' stories before they came to my class. The following are highlighted vignettes of my interactions with the kids. These demonstrate the circular lines of authority that I believe makes the teacher more available to the students. Though the linear hierarchy is broken down, the respect for the teacher is still there, but in return the teacher must respect the students for who they are and what they bring to the community of the classroom.

Gaining Trust of Respected Elders in the Community: Family Night

The Tribal Elder teacher gains the respect and trust of the respected elders in the community, which are really the other "Tribal Elders" outside of school. I gained entry

into the Rise Up program by going to the office on campus one day a few years ago and talking to the director and the Academic Coordinator. The Director told me at the time that she was a little shocked that someone from the "hard sciences" would just walk over and volunteer their services. I told her I had an ulterior motive as their program provided a good opportunity for me to do my research. I also told her I missed teaching high school students. She asked me about which high schools I taught and when I told her two alternative high schools for five years each, I gained some instant "street cred." After we talked some more about their students including their triumphs and let downs, she sent me over to the Academic Coordinator so he could get more information.

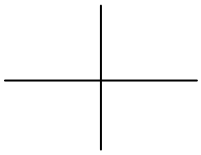
The Academic Coordinator asked me if I would like to come by a few afternoons and do some math activities with the students. During the school year the Rise Up students come to the campus one afternoon a week for homework help, counseling, and various other activities that helps assure their retention in the program. I said that would be fine. This was really a screening for me and for the leaders of the Rise Up program to see if I was a good fit with the students. The afternoons went very well and thus I was hired to be the math teacher for the summer session. In addition, I got to meet many of the students before the summer began and I had gained the some modicum of respect the leaders of the program. This past summer was my third summer teaching.

Over the past two summers one annual event in which I participated was Family Night. This usually took place during the third week of the Summer Academy. There is a DJ for karaoke, light snacks, games, and tables set up for people to talk. I have not yet volunteered my "pipes" to karaoke, though that seemed to be the high point of the festivities.

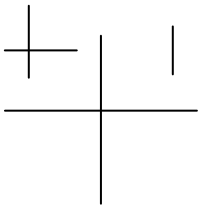
When I attended the event this past summer, one of the fathers came up to me with a big smile and greeted me with a strong handshake and a bear hug, "Mr. Riggs!" he exclaimed. "Are you gonna slap some bones with us again tonight." It was Chanise's father. The year before he and a few other fathers had played a serious game of dominoes. I told him I sure was as we made our way to the table to play.

For the uninitiated, "slapping bones" is the hip-hop term for playing dominoes, a game I learned to play well during my years in alternative high schools. There is a mathematical strategy to the game, and the scoring sheets developed by the players on a scratch piece of paper have a very symmetrical and recursive pattern to them. They are fractals. No numbers are used to score. The first ten points is represented by a large "+". This is called your house and each pencil stroke of the "+" represents five points. After you get your first large "+" built, then each subsequent "+" you score (10 points) goes into one of the "quadrants" of your first "house." When your "house" is full you have 50 points; three houses (150 points) is a win.

Here is your first ten points:



Here is 25 points:



This provides an excellent jumping off point for students to see a "recursive" pattern. Many of the students are pleased to discover they already know how to build fractals. In previous summers I've used this domino-scoring pattern to begin a small unit on fractals. This is an example of ethnomathematics; the purposeful use of a mathematical symbol within a cultural group. In addition, when I use this scoring system to start a small unit on fractals, I am using culturally relevant ethnomathematics.

Games also provide an opportunity to come together as a community. On this night, like the previous year, I played dominoes with Chanise's father and Charlene's father, who I just met that night. Our fourth was a young man of about 10 who was learning to play. He didn't belong to the dads mentioned, I think he was Jarrod's little brother, but he seemed happy with the ribbing he was getting from the other two men and being the center of attention. I was a curious oddity to him as he kept laughing whenever I used "street talk" during the game. Parents playing dominoes (and the kids too) with me for the first time are always surprised how I know the "lingo" of dominoes. Phrases like "wash the bones" (shuffling), "whose got the big-six'" (double six-). And if I get lucky enough to slap down the six-trey after that initial play of the big-six which scores fifteen points, I'll call out, "Christina!" This is bones-talk for a fifteen. One must call out when you score, or you will not receive the points. During this particular game, if someone else scores a fifteen or twenty (twenty five is about the most you can score on a turn-30?) I'll mutter, "you better go on with that." Always brings a laugh, followed by the question, "How do you know about that?" I just shrug and then tell my background. (Field notes, July 11)

A Tribal Elder teacher must also gain the respect of the parents and other respected adults in the community. During the evening I had several other parents come up to me and say how much their child enjoyed my class, but what the parent really liked was the speech I gave at the closing ceremony of the previous summer's Academy. A few parents had asked for a copy of the speech, and I made sure the Program Director had a few. The speech can be found in Appendix H. The Director of Rise Up has a copy of the speech in her office and has shared it in her doctorate classes as well as with friends in her church and community.

I have discussed the class as a whole, the lessons, and a few of the individual students. The following analysis is of three students and the relationship we had which I believe encapsulates what constitutes Tribal Elder teaching. I have purposely avoided mentioning these students (except maybe Summer once before) so that their stories can be illumined here. These stories are culled from my field notes, reflections, audio recorded interviews, and the students mathematical autobiographies.

Tiffany and Essence

When we were investigating taking the slope of a line given two points, Tiffany raised her hand for me to help her. We entered into a circular dialogue that went something like this:

Tiffany[7]: I need help. I don't get it.

[7] It should be noted at this juncture that all the kids had spent seven nights on the university campus. They were all a little tired, homesick, and not really in the mood to learn too much—especially the young ones. Thus, much of Tiffany's prickliness, could be attributed to that.

Me: Okay, what don't you get? (I think it is important that students articulate what they don't understand. Her head was down on her desk and she hadn't written anything on her sheet.)

Tiffany: All of it.

Me: Well, we have two points, let's label the x-one and y-one on this point and the x-two and y-two on this point. What's the formula for the slope of the line?

Tiffany half-heartedly pointed to the only thing written on her paper. Her entire body language showed that she was daring me to teach her something. I have seen teachers have different reactions to such behavior. One method is to chastise the student for not trying and walk away. This leaves both the student and the teacher angry. It is also the authoritative model of teaching. The second is to do the work for the student. This is a trap many white teachers fall into while working with African American students. It is my belief that many white teachers have bought so much into the deficit theories of education about these children, that we just do it for them, give them an A , and feel good about ourselves. The third option is reaffirming the relationship and her ability. This is what I used to do, but I'm a little rusty after six years of teaching college, is to ask, "What's wrong, Tiffany? This isn't like you," in kind of a growly quiet ("dad"?) voice. I didn't do that, mainly because I didn't know Tiffany that well. Thus I did a modification of option two.

Me: Okay let's do the first one together. Write down m equals…

Tiffany does this.

Me: Good, now substitute in the numbers of the points for the variables in the formula. Like this, see this first point says, x-one and this other point has x-two. Put those in the denominator- (Tiffany cut me off.)

Tiffany: I don't get it.

Me: You don't get denominator?

Tiffany: No, I don't get those. She points to the two points. Actually she did get that they were points, we had plotted them, and drew the line that contained them. She had that on her paper. By now, I had spent probably three to four minutes with Tiffany. So, in typical "white savior" mode and almost hating myself for doing it, I did the first problem as her head continued to lie on her arm. Through the entire process I used the language of mathematics as I was doing the problem. When I finished I said, "Okay, now you do the next one."

Tiffany: I don't get it.

At this moment, without any "looks" or comment, I slid over to another student at Tiffany's table who needed help. Actually, this student, Ta'lia didn't require help she just wanted validation for the problems she had finished. Tiffany was offended.

Tiffany: You didn't even help me! I told you I didn't get it.

I just smiled. However, another student, Essence who I have known for three years now (and the two of us had plenty of "Tiffany moments" back when Essence was just a freshman) chimed in, "He tried but you wouldn't let him. Shoot, you just played dumb."

Tiffany rolled her eyes and laid her head back down on her arm. However, a curious thing happened. She was looking at the next two points, I watched her find the

slope which she did—it was incorrect—an easy mistake was made where the subtraction of a negative threw her off—but she finished it. She looked up at me and asked, "Is this right?"

"Great try," I answered, you've got the concept, but you made a small mistake here," and I pointed to a negative subtraction error.

"Oh," Tiffany said and quickly corrected it without any more prompting from me.

"I don't get it," I muttered teasingly under my breath as I walked away.

Two things of importance happened in that moment. First, Tiffany and I started figuring out how we were going to get along for the summer. Second, and just as important, Essence established herself as an elder in the room. She disciplined Tiffany in an appropriate manner that did not disrupt the harmony of the classroom, nor make Tiffany angry. This added to the familial environment that is established by Tribal Elders. We are kin. On my last afternoon with the kids before their graduation celebration, I would find out from Tiffany why she had been so difficult.

Essence and I had typical "Tiffany" type moments three summers earlier. It was the first academy for both of us. Essence wasn't quite as defiant as Tiffany but she did not want to be there. She was also young and very immature. Basically she was throwing a tantrum—the fourteen-year-old girl eye roll. Essence described her worst math experience this way:

> When I realized that I very much so disliked math with a passion, I was in 6th grade.
> There were so many different numbers and things that I was not seeing.
> I'm not sure what type of math it was, but it looked very difficult on the overhead.
> I don't even know how I passed my math classes with A's.

I have seen this type of thing over and over in math class in the urban core with our young ladies. They are quiet. They don't make a fuss. The teachers reward them with A's thus setting them up for failure in their future math classes. This can cause resentment towards math.

Essence and I reached a kind of détente' for the first part of the Summer Academy. She would do most of her work and I wouldn't really talk to her in class. One day though as I was watching the students out my window, I watched Essence snatch a ball cap off the head of one of the boys. Essence was really kind of a prankster outside of my class. The boy gave chase, but Essence quickly outran him and I came into the hall just as she was bounding up the stairs two-at-a-time barely out of breath. At one time I had coached track. I recognized that kind of gait and conditioning.

"You run track?" I asked Essence several minutes after class had started and the young man got his hat back. I asked without really looking at her and just kind of muttered it under my breath.

"Yeah," she said without really looking up from her work.

"Let me guess, 100 and 200? Maybe hurdles?"

"Nah, I don't do hurdles," she said, "they scare me. But I do the 100 and 200 and 4 by 1."

"I thought so. You're pretty quick. You run at Central right?"

"Yeah."

"You the next Muna Lee?" (Muna Lee is an Olympic athlete from Central's proud tradition of track and field.)

For the first time in my class, Essence smiled. "I wish," she said with a laugh.

After that we were, as the kids would say, "straight." Maybe not "tight" yet, but "we was straight. It was all good." The Tribal Elder knows the community, knows the heroes of a community and uses them to help his or her students.

The Rise Up staff and I both used Essence as a mentor for Tiffany. They were room-mates, and though Essence said sometimes that Tiffany "gets on my nerves" she did not shirk her responsibilities. She understood the stakes. By fostering mentoring relationships in the classroom the Tribal Elder is building that community where everyone is dependent upon everyone else. This way ensures survival.

I interviewed the students on the last day of classes. It was still three days from their final day at the Academy. I joined the kids for lunch in the cafeteria. Tiffany came and sat by me and never left. As the other kids came and went after answering my questions, Tiffany stayed the entire time. I found out why she was being so tough. Her mother had died of stomach cancer in April. Her father was in Las Vegas and she hadn't seen him since she was six. Her aunt had just moved Tiffany north of river to live with a friend of hers and Tiffany was commuting to the Rise Up Academy. Tiffany no longer lived in the neighborhood where she grew up. These revelations were slowly revealed to me over the course of the hour I sat in the cafeteria. It took me that long to realize what a real researcher and Tribal Elder needs to do at times: Shut up and listen!

I knew then why we had had so much trouble in the beginning. In one of my weekly instructor reports to the staff I had written, "Tiffany kind of has an attitude." In the very same report, which was written after the first week of school I wrote of Essence, "Essence is all grown up! She is definitely taking a leadership role in the class."

Tiffany received the "Most Improved Student" award at the end of the Academy. I don't know if Tiffany will be coming back since her home situation is so unsettled. The Rise Up staff is working on it.

Kirby

Kirby was an outgoing and likeable kid who got along with almost everybody. Like many African American males he had some bad experiences in math class. Here is what he wrote in his math autobiography:

> I realize I hated when I was in second grade when I was put in a Math Bowl. We made it to the second round and it was my turn to answer the question I was up. It's your turn, Kirby.
>
> What's two and two? The teacher asked!
> I froze up. My answer: 8.
>
> I got laughed at by my class. I got talked about my whole 2nd grade year.
> The main thing I was mad about, didn't none of my friends stayed to help me out and ask was I okay.
>
> But all they did was talk about me. Call me names like "stupid head" and "no brains, Kirby."
> This is the reason I hate math.

Kirby did show resilience and has a strong positive identity. One day when we were talking about the Western history of science, I mentioned Galileo and Newton. Kirby said with pride that he had the same name as Lord Kirby. I told Kirby I was impressed he knew about him.

One of the techniques I've adopted is the "call and response" type classroom. "Call and response" is a predominant way church is conducted in the African American community. The preacher or lay leader say something significant, or ask a question, the congregation vocalizes a response. Eruptions of "A-men" and "tell'em brother/sister" are

common and expected throughout the service. In a "call and response" classroom, I don't have the students hold up their hands waiting for me to call on them. I just expect them to blurt out the answers. I didn't develop this technique as some "culturally responsive teaching", rather, as a teacher I'm just too impatient and not disciplined enough to have the students hold up their hands before I call on them. (Yes, this can have negative ramifications—young women feel intimidated and don't answer, thus they don't feel like they're a part of class. We have other ways of dealing with that. See above interaction with Tiffany.)

During a class toward the end of the summer, I was doing the definition of the derivative and Deonica "got it." She saw how we were taking the slope of a line so she was calling out what came next. Kirby, who just a few days before when we were looking at zeroes of functions and where some functions go to infinity at certain points, had said, "Man this stuff is easy." I said, "Actually, Kirby, this is real mathematics. I'm glad you find it easy." Later I asked him why he thought it was so easy, "Because," he said, "you break it down." That didn't happen this day.

Two days after that encounter, Deonica was getting rattling off how the definition of the derivative came from the same idea as finding the slope of a line, Kirby had a different reaction to mathematics, and upon reflection, my teaching methods. Kirby became frustrated---some of that may have had to do with the "call and response" atmosphere and Deonica's streak of correct answers. However, I think it went deeper than that. Just two days before, "Math was easy" now it was hard. Once again Kirby felt dumb. He said, "Man, I just don't get this!"

And I said, "That's because it's hard and you haven't allowed it to sink in yet."

"But Deonica gets it!" He said, tears nearly welling in his eyes.

I really didn't know what to say. I talked to him after class and told him he was smart. I told him that for not even having algebra he was doing real good. I asked him if he felt good about taking algebra one the next year. He said, "After this summer it will be a snap."

The students want to know if you are going to give up something precious like your time to teach them. Eventually, this one-on-one time diminishes and students, once they have established a relationship with you as the teacher, then grow into independent learners.

Last Things: Post-Test Scores and Questionnaire

I gave the students a pre-test on the first day of the Summer Academy and the same test on the second to last day we were together. The tests are a requirement of the federal grant the Rise Up program receives. The pre- and post-test I gave can be found in Appendix F. The class average of all 31 students who took the pre-test was an 11/40. The class average on the post-test was a 32/40. That seems like a miraculous improvement, but to compare the two scores is kind of absurd. I designed the test. I used the exercise of writing the test as a way to plan the unit I would teach that summer. Each section of the test follows closely with the lessons I wrote. This was "teaching to the test" taken to the extreme.

So what was the point of the test? I use the test in a qualitative way to measure each class' growth as a community and each student's growth as a mathematician. The growth in community is easy to gauge by the "buzz." When I pass out the pre-test the students are stone silent. It is written on their faces, "Oh boy, here comes another math

test I'm going to fail." They begin working and the room is silent. The students who had not taken algebra, just flip through the test quickly and then close the test, put their heads down, and take a nap. The older students who had taken math through algebra two worked on it most of the hour but did not understand the calculus part at all. The room was silent, and they all "did their own work" in the classic Eurocentric style of schooling.

When I give the post-test there was a definite "buzz" in the room. The kids were actually excited about showing off what they knew. The rise in their confidence level is palpable. Within the first five minutes after passing out the test, hands shoot up in the air. The kids aren't stuck on a problem. Instead they're showing me how they know how to solve this problem. Sometimes they get a little stuck and they want some guidance, which is given happily, and then they continue on. This shows how they've grown as mathematicians. After about ten minutes, the students have divided themselves up in groups and are working out the problems together. The kids don't divide themselves up as I've seen at times where the students who understand the math work together leaving the weaker students to flounder but instead there is a good mix of mathematical talent among the groups.

When the students took their post-test, was I getting accurate test score data? That depends on what kind of data you want to measure. If you want to have a strict comparisons of the pre-test scores with the post-test score to do a t-test on the means, then the answer is, "no" I can't really use the data for that purpose. But that wasn't the point of the Summer Academy or the purpose of this action research. During the post-test I want to see enthusiasm for the subject matter. I want to see an effort from the students that is not motivated by a test score, but this effort and zeal comes from a desire

to actually want to do mathematics. I want them to enjoy the experience and have the opportunity to "show off" what they know. When I looked out and saw how engaged both classes were in taking the post-test and the fun they were having actually doing mathematics, I knew learning had taken place and that many of the students had grasped the key tenants of this difficult material. To destroy that class cohesion and unity by breaking up the groups, turning off the "buzz", and forcing them to take the test silently by themselves so that I can get some kind of sacred t-test metric, to me that would have been educationally criminal.

Table 2 is a questionnaire I gave the students during the "liquid nitrogen" ice cream social on our last day together. At the end of each Summer Academy, the students come to my physics lab rather than the normal classroom. Here we do "blow up" demonstrations and also make liquid nitrogen ice cream. I took this opportunity to tell them the tape recorder was running and I audio recorded the party. The students did not put their names on the questionnaires and I had one of the Academy Assistants collect them.

Quantitatively I believe the results are telling. Most of the students claimed they enjoyed learning mathematics, which was more than the students who made that claim on their math autobiographies. I think this means the structure of the class and *how* the class was taught had more influence on the students' affinity for mathematics then *what* is taught. Was this due to my gifted teaching abilities? No. I believe this affinity towards mathematics had to do with the structure of the class that fit the comfort level of the students. The Tribal Elder structure, those circular lines of authority, of the classroom fit

the identity, security, and validity of the field dependent learners as outlined in Chapter 3 (Harvey & Stiff, 1988).

Most of the students believed they were good in math, had a lot of self-confidence when it came to mathematics, and understand the importance of taking more mathematics courses. The survey suggests that this group of students have had an overall positive mathematical socialization which contradicts some of the research (Ladsen-Billings, 1997; Martin, 2002; Martin, 2009). However, we should not jump to the conclusion here that these kids are just fine and that their schooling has given them this positive attitude towards mathematics. As we saw in the above vignettes, most had at least one, if not several episodes of mathematics in what Martin (2008) would describe as learning math from a racialized context. These episodes can be devastating to a student's self-esteem and have a very negative impact upon their mathematical socialization. That these students are able to bounce back from these incidents says more about their resilience as fighters for their own education, than it does about one or two five-week Summer Academies with me.

Yet, because these students have had so many negative experiences in math, and the social and political factors that detract from their educational experiences, this positive mathematical socialization is fragile. Many of these students' very lives are fragile. This I believe is why the teacher in the role of Tribal Elder is so important. Though I avoid a prescriptive list of actions a Tribal Elder teacher must take, it is hoped through these this research project, a sense of the style of teaching a Tribal Elder projects can be adopted by other professionals.

Table 2.-- Post-Summer Academy Survey

Key: SA: Strongly Agree **A:** Agree **N:** Neutral **D:** Disagree **SD:** Strongly Disagree

	Statement	SA	A	N	D	SD
1.	I enjoy learning mathematics.	**19**	**8**	**5**		**1**
2.	Doing mathematics is doing something, which I think I just can't do.	**3**	**4**	**6**	**3**	**17**
3.	I am good at mathematics.	**10**	**9**	**6**	**6**	**2**
4.	I feel that using the graphing calculator has caused a decline in my basic arithmetic facts.	**1**	**8**	**9**	**9**	**9**
5.	If I had a choice, I would not take anymore mathematics courses in school.	**5**	**4**	**8**	**3**	**11**
6.	Mathematics is useful for solving everyday problems.	**18**	**7**	**7**	**2**	
7.	Calculus is too hard for me.	**4**	**4**	**9**	**11**	**5**
8.	I am looking forward to taking more mathematics courses.	**8**	**7**	**10**	**2**	**3**
9.	No matter how hard I try, I am not the type to do well in mathematics.	**3**	**2**	**7**	**9**	**12**
10.	I feel confident in solving problems in mathematics.	**8**	**12**	**9**	**2**	**1**
11.	I find mathematics very boring and dull.	**2**	**1**	**12**	**7**	**12**
12.	I have a lot of self-confidence when it comes to mathematics.	**10**	**9**	**6**	**5**	**2**
13.	I understand mathematics better if I solve problems using paper and pencil.	**9**	**7**	**13**	**2**	**1**
14.	I will use mathematics in many ways as an adult.	**10**	**12**	**6**	**3**	**1**
15.	Learning mathematics involves mostly memorizing.	**11**	**10**	**6**	**2**	**3**
16.	I see mathematics as a subject I will rarely use in daily life.	**5**	**6**	**8**	**7**	**6**
17.	A graphing calculator allowed me to solve problems I could not solve before.	**12**	**7**	**10**	**1**	**1**
18.	Learning mathematics mostly involves exploring problems to discover patterns and make generalizations.	**9**	**15**	**11**	**1**	**1**
19.	I rely on my graphing calculator too much when solving problems.	**5**	**6**	**10**	**8**	**4**
20.	It is important to know mathematics in order to get a good job.	**17**	**8**	**5**	**1**	

Researcher/Educator Growth

During an action research project the researcher should have moments of self-discovery. I had several, especially after I had time to reflect and while I was coding the data. I found that how I construct my classroom and my teaching style is not going to change. I have learned how to manage a classroom and that comes with experience, but I have not changed the structure of my classroom in the fifteen years of teaching. I think much of that has to do with relinquishing control. As mentioned above, I construct my own scaffolding worksheets for the students to use and the call and response nature of my classroom has not changed.

This poses a problem if one of the stated purposes of this research was to provide a model for other white teachers to emulate. If I haven't changed my teaching technique and style, why should I expect them to change their teaching style? The answer is that though the structure of my classroom has changed, my focus over the years has changed significantly. What has changed is that mathematics takes a back seat to building relationships with the students. The mathematics provides a pretext for the students and me to "get together" but what happens in those first few weeks is relationship building. The students and I need to get to know each other. It is impossible for the Tribal Elder teacher to guide his or her students through the treacherous dark woods of mathematics and the attitudes of the dominant culture, without getting to know the students first. The discovery that as the teacher you are the one to lead them puts you on the side of your students. This means the Tribal Elder teacher is constantly questioning the status quo in schools, which leads the teacher to become a true advocate.

Another discovery was that for me, culturally responsive teaching trumps culturally relevant teaching. It has always been difficult for to lead the students in a culturally relevant lesson. Though outbursts like Akeesha's, "I hate this Black-White stuff, it makes my stomach hurt!" were rare. The pall and unease that settles over the classroom during my attempts at CRP, were palpable. The students and I both could not wait to get back to the mathematics. However, I think adopting the class to cultural norms of the students, which include the call and response, working in self=selected groups, and making sure "everybody gets it" before moving on to the next lesson, provides a culturally responsive classroom in which the students thrive. This was evidenced in the vignettes above.

The above description of my classroom with its circular lines of authority, may appear difficult for some white teachers to emulate. I found adopting this type of teaching style requires surrendering some control to your students. They still want you to be "in charge" of the classroom, chaos can not be the order of the day. However, the subject matter is secondary (though still important) and establishing those circular lines of authority take precedence. The beauty of this though of this type of teaching, is once the teacher has become accustomed to it, teaching becomes relaxing. You are no longer on edge. It is okay to make a mistake in front of the students and it is okay to make mistakes in dealing with students. These circular lines of authority allow the teacher to tell a student, "I'm sorry, I was out of line yesterday." The teacher is not relinquishing authority, the teacher is acting like a human. I have found that both the my students and me as a teacher grow when this happens.

As a researcher I discovered I have a long way to go in my investigative techniques. My field notes were detailed and I grew accustomed to writing reflectively each day, in fact this helped me grow as a teacher. However, when I listened to my interviews during the transcription, I was shocked about how much of the interview I was "walking all over" the students' responses. A good interviewer does not make themselves part of the interviewing process. That leads to a limitation of this research project is the amateurish interviews may not provide as rich a detail as needed

CHAPTER 5

CONCLUSIONS

Tribal Elder Models

As illuminated in chapter one, there exists a difference between White students and students of color on scores on standardized tests (Gutierrez, 2008; Gutstein, 2003; Hilliard, 2003; Ladson-Billings, 1997; Ladson-Billings, 2006; Leonard, 2008; Lubienski, 2000). Several aspects of this phenomenon are troubling. One troubling aspect of this difference is that stakeholders, parents, teachers, education administrators and schools of education put so much stock into these standardized test scores, which have been shown repeatedly to contain cultural and racial bias and do not measure a child's creativity, capacity to learn, or problem solving ability (Hilliard, 1995; Hilliard, 2003; Lipka, 2005; Martin 2003; Martin & McGee, 2009). Another aspect that gives us pause is that standardized test scores of African American kindergarten students are on par with White students of the same age. This "achievement gap" begins to appear around the 4th grade and becomes quite pronounced by grade 10 (Lubienski, 2000). Allowing just for a moment that these standardized test scores do have some merit, this "gap" that creeps in between grades four and ten means something adverse happens to these African American children in their ten years of schooling between the ages of five and fifteen. The concerned parties mentioned above who watch these test scores closely want to know what happened?

What happened is a worthwhile question, but the third troubling aspect of these scores is that too often the answers are sought in examining the deficits of the African American students and not in the addressing the cruel circumstances in which many of

these children find themselves. These African American children become the "problem" the thinking goes, because the White students keep besting them on these tests. There must be something wrong with these African American children for them to fall so far behind. "We"—meaning the white dominant culture and the Black leaders we've been able to succor to our way of thinking—must "fix" them.

Some of these fixes come in the form of the missionary (White Savior) who must rescue these children from their blackness (Martin, 2007). The thinking is that if we coddle them by giving them easier assignments, develop lower-track classes for them, and pass them along we will have done our jobs (Holbrook, 2006). On the opposite end is what Martin (2007) would call the cannibal teaching method. This is a variation of what Haberman (2010) calls the teaching orientation of the lifer/quitter. The cannibal sees mathematics as value free, thus no adjustments in the classroom structure or variations in the way mathematics is taught are necessary. The thinking of the cannibal teacher is that, "The way I learned mathematics worked just fine for me, so why do I need to adjust my classroom?" Once the cannibal in the urban core becomes frustrated because the students' test scores are sinking lower and lower, the lifer/quitter mode of instruction kicks into high gear. New material is compressed into mind-numbing work sheets, which are passed out to the student with little or no comment. Thus when the students do poorly in class, which then leads to the student failing the class, which snowballs finally into the student dropping out, the lifer/quitter takes solace in the fact that he or she presented the material and snorts, "what they do with it I can't control." The hidden message coming from the Missionary, Cannibal, and the lifer/quitter teacher in the urban core is that these African American students are ill-equipped both socially

and intellectually to handle mathematics (Berry, 2008; Davis & Martin, 2008; Stinson, 2010).

Another factor contributing to the popular yet racist argument that African-American children are flawed and just can't learn high-level mathematics is that middleclass to upper middleclass African American students in suburban schools score worse on these standardized tests than White students from a much lower SES. The reasoning goes that since these African American students are now exposed to the same learning environment as their White peers, obviously these African American students are inferior. The problem with this argument is that it makes the assumption the White students and African American students are treated just the same and given the same opportunities in the schools in which they walk the same halls. Research indicates this is not the case. African American students' do not receive the same recognition for the same achievement as white students, or when they do great things in math class, their achievements are ignored. These children soon discover that under these circumstances their contributions to the mathematics classroom are not valued, thus many African American students tend to give up on mathematics because they don't see the point in trying. When this happens these African American students are then placed in remedial classes and the prophecy of "these kids just can't learn mathematics" is fulfilled (Davis & Martin, 2009; Hilliard, 1999; Ladson-Billings, 1997 & 2006; Martin, 2000; Walker & McCoy, 1997).

The above examples of the flawed and racist thinking that African American children are incapable of learning higher mathematics provided the motivation for this research paper. Adding to this motivation was my own personal experiences with "at-

risk" urban high school students who proved quite capable of doing high-level mathematics. The fact that some of these outcasts from "proper society" actually sought out math class instead of gym class demonstrates their willingness to learn. In this case a challenging math class that was highly structured, but structured around field dependent learners, using graphing calculators had more appeal than a haphazard game of basketball.

It was the contention of this research paper that African American students are not the problem, nor do they have problems learning mathematics. The issue is also not the racist implication that African American children cannot learn high-level mathematics. The problem is not with these children. As The Who song claims, "*the kids are all right.*" The problem is the almost nightmarish circumstances these children go through at school and the myriad of obstacles these African American children must negotiate on a daily basis. Their sheltered White peers in the suburbs have no idea that these circumstances exist. These obstacles and circumstances are what Martin (2000) called the racialized context of these children's mathematics education.

The foundation of this research project was to remove the racialized context that permeates many urban classrooms. I attempted to remove the Eurocentric culture of the "typical" high school classroom and replace it with a culture more familiar to the structures my urban students find in their homes and churches. One reason these racialized contexts exist is that 83% of the teachers of minority children are White (Leonard, 2008). This research project provides models that may assist the White teacher of African American children to become conscious of the racialized contexts that can exist in the classroom and to move past them. This means breaking down the Eurocentric

structure that exists in most classrooms. Eurocentrism is the belief that Western thought, and culture beginning with Greek mathematics, is superior to the culture of other groups (D'Ambrosio, 1999).

The research indicates that an effective way to break down the Eurocentric classroom that is alien and uncomfortable to African American students is to employ a culturally relevant pedagogy (Chu & Rubel, 2009; Eglash etal, 2006; Gay, 2000; Leonard, 2008). This is where the teacher contextualizes the mathematics by using cultural icons, stories, art, or famous people from the culture of the students so they may identify with these cultural figures and feel more at ease in the classroom. Others have had success approaching the teaching of mathematics from the social justice perspective where mathematics is used to uncover the *savage inequalities* that exist in the lives of marginalized students in the hopes that they will use this information to become an agent of change (Frankenstein, 1990; Gutstien, 2003; Tate, 1997).

Both of these techniques have merit and the research indicates they have a powerful impact if performed by an expert in culturally relevant pedagogy or in teaching for social justice. However I must confess my own attempts at these curricular treatments have fallen flat. I find myself teaching outside of my comfort level—which it never hurts to stretch oneself, but I didn't even feel like myself teaching this way. I found that exposing the students to the inequities they face each day with no real solutions for them, was a little cruel. I also found that the mathematics found in many of these units was not much beyond using simple statistics. On the other end of the spectrum, the culturally situated design tools of Eglash, etal (2006) though mathematically challenging, often proved almost too challenging. This makes these

curricular treatments restrictive to a harried teacher without some professional development in the use of these design tools (in fact, the program is set up to be run that way). I found my comfort level in teaching through an ethnomathematical lens by using a culturally *responsive* pedagogy.

The following three models provide an outline to a possible classroom construct for effective teaching in the urban core. They are models instead of the more prescriptive recommendations.

Model One: Teaching Through An Ethnomathematical Lens that Is Anathema to the Current Deficit Theories of African-American Children.

Teaching through an ethnomathematical lens means adopting a Freirean epistemology where the teacher recognizes that the culture of the students from an oppressed segment of society has value and that these children are capable, and deserve to be taught rich mathematics. D'Ambrosio (1999) writes that in today's complex world we need to teach for literacy, matheracy, and technocracy. Literacy is for people outside the dominant culture to be able to read and write in the language of the dominant culture, but to never forget the stories of their own culture and to learn the stories of other cultures. Matheracy is to have a deep understanding of how mathematics is intertwined in our world, but also to study mathematics for the sake of its implicit beauty. Technocracy is to have the ability to use the tools of today—based on your matheracy and literacy levels—for the betterment of the future, and to build tools of peace and not destruction.

Powell (2002) demonstrates how all three are achieved by using the rich mathematical heritage of the students' culture. Powell used the Rhind Papyrus out of

Egypt to teach college algebra. The Rhind Papyrus contained deep algebraic equations that used quadratics and cubics in architectural designs. I used the story that the rudiments of calculus were first developed in Africa—Egypt to be exact—but was destroyed in the libraries during conquest (Sagan, 1979). The students then had a story from their heritage filled with deep and complex mathematics. Now mathematics was not something done to them, but something their forefathers had created. Also in the students' own work and autobiographies opportunities were found to show the students that they are mathematicians and have the talent to navigate this technical world.

Story telling is an integral part of holistic and field dependent learning style of African American students (Perry, 2005; Harvey & Stiff, 1988). The classroom teacher engages the students through an ethnomathematics lens by incorporating the students' own stories and the stories of their rich mathematical past, into the daily discourse of the classroom. One way to start is to provide your own story to the students in a relaxed atmosphere. Before students open up to teachers, they want to know you can be trusted. One demonstration of trust is to tell your story or your history. No matter the age or years of experience of the teacher, the teacher has a story. And, no matter the age or years of schooling students have had, they want to hear that story.

After I tell my story I give the students a project to do that has nothing to do with African culture or my culture, yet is multicultural. I have them write their names colorfully on their manila folders in which they keep their work, in the Japanese phonetic alphabet of hiragana and katakana. I pass out copies of the hiragana and katakana alphabets along with colorful markers. I have a few students call out their names and this allows me to demonstrate on the whiteboard how these names would be written plus I

pronounce their names the way a Japanese person might say it. It doesn't take long for each of the students then to want help with the pronunciation and spelling. Not only do they enjoy listening to their own names in Japanese, they enjoy hearing the sounds of their peers' names. Soon, they are calling each other by their Japanese names and, little do they know, that during this exchange I have learned all their names. At the end of the class I say, "It is time for a quiz." Groans ensue all around. Then I tell them that the quiz is for me and I walk by each student and say their name. I may not get it perfect, but the effort is appreciated and by the time I've gone around twice, I have all their names down.

Our names are important to us. One of the first things a dominant culture does to subjugate another, is to strip them of their identity (Freire, 1970). Names have value and it means something when the authority figure in the room takes the time to learn their names. By the time I have finished naming all the students, trust is built, the community within the class is strengthened, and the students know they are valued. This is one way to focus the class through the ethnomathematics lens. Besides the beginnings of a real community forming, two other things have happened: First while I was helping them with their names, they asked me all about my six years living in Okinawa. This led to more stories about me and for me to ask stories about them. The second thing is they learned about another culture, Japanese. Some of the hiragana and katakana along with Kanji is used in tattoo designs, so the students have seen them. Two cultures thus collide in learning.

As the students leave that first day, fist bumps abound as they depart with some of the more outgoing students, actually saying, "I'll see ya tomorrow, Mr. Riggs." The seeds of me, as the instructor, have been planted. This cultural competence leads to a

breaking down of the Eurocentric classroom, which alienates African American students and creates a non-linear community where they can thrive. I also never start a class with a list of rules or expectations. Through my actions of showing them respect, I know they will reciprocate. This is what makes us caring human beings. Reading a list of rules and expectations is not only boring, it's degrading to your students and insulting to their parents. Building and sustaining this community is contained in the next recommendation.

Can any teacher use hiragana and katakana as a class "ice breaker?" No. That was not my point in relating that story. The point is that each teacher has some part of themselves that they can share and turn into an ice breaker. They have some part that is important to them that they wish to share in an attempt to build the community. As you open up to the students in this way you show them you are human, you are there for them, and you can be trusted. If the ethnomathematics lens teaches us anything, it is that we are all humans. We are humans deserving and needing a caring environment that nurtures us and allows us to grow. The essence of ethnomathematics is to treat one another as one human being to another and to use mathematics to promote peace, not division and destruction.

Model Two: Teaching as the Tribal Elder; Teaching Wise.

In chapter four several vignettes were provided that demonstrated actions and responses Tribal Elder teacher. The Tribal Elder teacher dismantles the Eurocentric structure of the typical classroom, which may be alien and uncomfortable to African American children. The Tribal Elder teacher replaces the linear, top-down authority structure with one that is circular where the students set the tone of the class. This does

not mean, that chaos reigns in the classroom and the teacher has no say, quite the opposite. The out of control classrooms that typify many of the current urban classrooms (whether that stigmatization is fair or not is for another discussion) is not a Tribal Elder classroom. Those classrooms do not have a circular authority structure; they reflect lazy teaching and having no authority in the classroom. These are the classrooms where the students are not learning. The classroom created by the Tribal Elder is one where relationships are built, contributions to the group as a whole are valued and cooperation among all parties is accepted. Lastly, the Tribal Elder teacher validates contributions made by individuals. These actions provide our field dependent students with an identity within the classroom group, security within that group, and the validation that they need as outlined in chapter three. These actions also give us a basis to try and formulate an answer to research question number two: How does a white teacher effectively adapt to the culture of an urban classroom?

Steele (1997) characterizes this type of teaching as "wise," a term he borrowed from Irving Goffman, who borrowed it from gay men and women of the 1950s. To these people a "wise" person was someone outside their group—heterosexual—who understood their full humanity despite the stigma of their sexual orientation. In the same vain, a "wise" teacher of African American students is one who is outside their group—in this case white—but understands them for all their humanity. Wise teachers understand and appreciate the debilitating effects four hundred years of bondage and racism have had on the African American people and the struggle the students have faced. Yet at the same time, the Tribal Elder teacher recognizes that in spite of all that, these children are brilliant and capable of learning higher mathematics, and that a small amount of justice is

served when the dominant culture is defied, demeaning curricular treatments like benchmarks are ignored, and these children are taught in an environment that nurtures and challenges them.

The wise strategies for teaching that Steele (1997) discusses dovetail nicely with the field dependent strategies recommended by Stiff and Harvey (1988). These strategies include optimistic teacher-student relationships where the teacher doesn't buy in to the stereotype of African American children being incapable of learning higher mathematics. Another strategy is giving challenging work to the students instead of remediation, thus showing respect for their abilities. And lastly, Steele recommends teaching the students that through hard work their intelligence grows. By doing this, the teacher removes the stigma that you are either born with mathematical ability or not and you are helpless to do anything about it.

The data analysis of the vignettes from chapter four provides compelling evidence that the strategies of wise teaching in combination with the classroom structure favorable for field dependent learners took place in my Rise Up Academy classroom. This leads us to answering the first research question, which was: How does a white teacher in an urban classroom become a Tribal Elder teacher?

The research question defies a simple, one sentence answer. Rather a practitioner needs to look at the question as a jigsaw puzzle with many small pieces that need to fit together to make a coherent whole. Yet, this is a different kind of jigsaw puzzle. It is a puzzle that doesn't have a pretty picture on the outside of the box that one can follow as each piece is picked up and examined to see *exactly* where it goes. This jigsaw puzzle doesn't work that way. In this puzzle the teacher fetches in their head their own pretty

picture on the outside of the box, then grounded in research of best practices—many of which were discussed in chapters two, three, and four—builds that puzzle using the pieces that appeal to their strengths in subject matter and personality. The actions I took with my Rise Up students were my pieces, and they not only fit together to make the picture I had of the classroom in my mind, these pieces fit the parameters mentioned above about wise teaching to field dependent learners.

The idea of introducing calculus to classes consisting of rising freshmen is an example of challenging the students instead of having five weeks of remediation. This was my first piece to my particular puzzle. The students felt challenged but not afraid of calculus as was in evidence on the post-academy survey. Some of the students even bragged to their friends that they were learning calculus. The cultural tie-in that calculus had its origins in ancient Egypt also kept the subject from being "other." The Tribal Elder teacher claims through his or actions, "I know you can do this. Trust me, and we will go on this journey together."

My second piece was an amalgam of using the students' vernacular—at times in a humorous way—which made the students feel more at ease along with a validation of their achievements. I validated each student's achievements in the class by writing meaningful comments on their work, going from student-to-student during instruction time and engaging with the students in dialogue both in a high mathematics register, and then slipping into the more comfortable everyday language. The students were allowed to work in self-selected groups, though at times I would ease a struggling student into a group of strong students. Working in groups and one-on-one instruction was one way as a class we tried to make sure "everybody got it" before moving to the next unit. Based

on the positive attitudes reflected in the exit survey about their ability to do calculus, the elevated status some of them achieved among their peer group in mathematics, and the final scores on the exit exam as well as the enthusiasm they showed for doing well, again as a group, on the exit exam, lends credence that the style of instruction was effective.

The third and last piece to my puzzle was the interaction with parents and siblings. While mingling socially with the parents of my Rise Up students at the Family Night and the Graduation Ceremony, I could not help but feel that I held a respected and elevated status with them. The tone of the parents and their comments such as, "My son/daughter talks about you all weekend." Or, "I wish my boy had you during the year, this seems to be the only time he gets math," led me to this conclusion. In addition, many of the parents remembered the speech I gave the summer before during the closing ceremonies and commented on how it moved them. Combining the establishment of close bonds with the parents and creating almost a family atmosphere in the classroom, is how the Tribal Elder teacher establishes himself as "kin."

Part of building the respect with the parents is to understand the stakes that are involved in the education of urban children. The Tribal Elder teachers convey through word, action, and deed that they know that failure could mean a life on the streets and possibly death. Most of time this doesn't need to be said, but the parents can pick up signals from the teacher so that they can ascertain the teacher's level of commitment and the teacher's knowledge of what is at stake. This is an important piece to the Tribal Elder jigsaw. Like the parents who teach their children how to survive in the White world, the Tribal Elder teacher also teaches the students the ways of the outside world and how to navigate that world to ensure their survival. The Tribal Elder teacher in the mathematics

classroom does this through teaching challenging mathematics. By teaching challenging mathematics the Tribal Elder is teaching for uplift, freedom, and liberation (Perry, 2003c).

Model Three: Collisions Leading to Creation vs. Annihilation

In particle physics there exist subatomic particles, with which most of us are familiar such as electrons, protons, and neutrons along with the more unfamiliar anti-particles, such as a positron (an electron with a positive charge). When an electron and positron collide, one of two things can happen: The particles can either destroy each other releasing photons (light waves/particles), which is annihilation, or they can smash together to create an antiparticle-particle pair--creation. A curious thing happens when these subatomic particles smash into one another and experience creation, they morph into something new and mysterious. During the collision each particle changes the sign of its charge; negatively charged electrons turn into positively charged positrons. In creation, each particle changes to make something better. Nature prefers annihilation though when these particles collide. Creation usually only happens in the lab. Thus creation takes effort and both particles have to give something up to create something new and mysterious.

I use this lesson from modern physics as an analogy for what happens in our mathematics classrooms in the urban core. Instead of positrons and electrons colliding, we have White teachers with their preconceived notions of the mathematical abilities of African American students and the "right way" to conduct class, while the students are

daring the White teacher to do what is necessary to teach them.[1] A collision of two cultures is taking place where the teachers and the students are at a Robert Johnson-esque crossroads. If annihilation takes place nothing is learned, the achievement gap widens, and that White teacher is looking for the first opportunity to get to a different school or career. But what would happen if a creation took place? In other words these colliding "particles" choose to give up a little to *create* something new, mysterious and wonderful? These questions lead to the third research question: Can a white teacher effectively adapt to the culture of an urban classroom and teach rigorous mathematics, such as calculus, in a style that's comfortable for the teacher and motivates the students?

In the data analysis of chapter four and in the literature review of chapter two, the case was made that our African American children are perfectly capable of learning higher-mathematics; again the kids are all right. Research suggests the onus for changing is on the White teachers who need to adapt by using effective culturally relevant or responsive pedagogy (Gay, 2000; Haberman, 2005; Leonard, 2008). This is easier said than done and the intent of this research paper is to provide a framework for what a culturally responsive classroom might look like. This type of model is scarce in the literature. There is a plethora of culturally relevant lessons, but with the exception of Gutstein and Ladson-Billings (Gutstein, 2002 & 2006, Ladson-Billings, 1994) very little has been written on how a White teacher can adapt to the culture of the urban classroom. But like our different subatomic particles colliding and each changing to make a new creation, the students also need to change, or in this case learn the language and ways of

[1] I cross-checked with my Rise Up students as to the race of some of the tribal elder teachers we discovered in chapter four; all of them were African American.

studying mathematics. The teacher, though is the catalyst that needs to make the first move.

The White teacher in the urban mathematics classroom must understand the life-or-death stakes in play with these children and, for these teachers to be effective they need to create almost a family environment in the classroom, or, rather a "tribe" with the teacher as the Tribal Elder. The main function of the Tribal Elder teacher is to show and demonstrate to the members of the tribe how to navigate the outside world for survival. To do this the teacher must accept the high level of energy required to teach with the sense of urgency and the intensity that is required. The teacher must also accept the heartbreak and sorrows that can come with this kind of commitment. There are times when the Tribal Elder teacher must attend funerals and visit students who are the victims of violence in the hospital.[2]

The question a White teacher in the urban core must ask and then answer is; what do you want to try and control? The options are do you want to focus on controlling the behavior of the kids—which many White and African American teachers have a preconceived notion will be "off the chain"[3]—or do you want to control your behavior and the content? The first option—controlling the kids—is exactly what they are expecting, and the novice teacher probably presumes it is the expectation of the principal, thus it is the option most often selected. Modifying the students' behavior manifests

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[2] In my ten years of teaching in the urban core I lost thirteen students to violent death. Five that I know of are in prison facing life sentences for heinous crimes. I don't sugar coat these realities in my pre-service teacher classes when I tell them they will probably attend more funerals than graduations.

[3] "off the chain" is a street-term meaning lose and dangerous, like a pit bull, that is a trained fighting dog, which has got loose in the neighborhood. It's off the chain.

itself in a long litany of classroom rules, "time-out" procedures, uniforms, canned curriculum chock full of remediation, all of which lead to low expectations of the teacher for the students, and low expectations of the students for the teacher. These low-expectations of the teacher lead to doing poorly in class. Looking at the results achieved from this tried and "not" true option, it does not seem to be working. The years of research and evidence dedicated to the problem seem to indicate that it will never work. I often ask White teachers in the urban core (who like me live in the suburbs and commute) if they would tolerate such schooling of their own children. The answer is always, "No." Hmmm.

The Tribal Elder teacher accepts that real teaching to those that are in the oppressed group by a dominant group is a radical act. So radical in fact, that Paulo Freire was exiled from Brazil for stirring up the masses (Freire, 1970). The Tribal Elder teacher's first radical act is to destroy the Eurocentric culture of the classroom and replace it with the classroom culture more conducive to the field dependent learner as illustrated above in Model One. This act may raise some eyebrows, but if implemented effectively should not bring any unwanted intrusion from the administration. The second act is to refuse to teach any canned or "adopted" curriculum that favors remediation and rote learning over a curriculum that is challenging and centered around discovery. This is the act that few do because doing so can cost the teacher their job. Thus the Tribal Elder is faced with the dilemma faced by any radical: Boldly go forth with what is right with the threat of getting fired, or choosing the more subversive route of not openly chucking the "adopted" curriculum out the window, but putting on a front of following the curriculum but going their own way behind closed doors. A fired Tribal Elder is not

going to do the kids any good at all, yet the subversive Tribal Elder is not being honest with the boss. For the creation of a new and wonderful classroom to take place, one of the choices must be made.

The one constant with urban education is that it is not easy. The life of the students and their parents is not easy. The challenges facing the teachers and administrators are not easy. Nothing worthwhile is easy, and it often requires moral courage and strength of will to address issues where lives are threatened and the rights of a people are being violated. However, this is what makes teaching in the urban core so exciting. The last research question was how does a White teacher become a Tribal Elder teacher in the urban core? The answer as illuminated here is nuanced and complex and requires the teacher to maybe risk their livelihood, and at times their life to make it work. In poker parlance, the Tribal Elder teacher is "all in."

Suggestions for Further Research

It is imperative that the grounded theory advanced in any qualitative research must be reinforced, or even refuted, by quantitative research that investigate the models proposed by the grounded theory. This is the next step for this research project. In other words, as the physicist and developer of the Programme for International Student Assessment (PISA) Andreas Schleicher says at the end of his talks, "Without data, you are just another person with an opinion" (Ripley, 2011). I envision this proceeding research to have two distinct stages.

The first stage will consist of creating a quantitative instrument that measures the attributes of a Tribal Elder teacher. One way to develop such an instrument is through observations of teachers by the researcher, or others, in which they will document the

attributes of a Tribal Elder teacher described in chapters 4 and five. There are two problems with this approach: One is that it would be very time consuming to get a large enough sample to lend statistical power to the observations. The second problem is observer bias could skew the data. Teacher observations of other teachers may not meet an objectivity threshold so that the data would be reliable.

Perhaps a better method for creating this instrument would be to have the instrument be student centered. Since the focus of this research project was on the development of relationships between the Tribal Elder teacher and the students and how that might have an impact on their mathematical learning, having the students fill out a Likert Scale type instrument on what they expect of their teachers might prove more meaningful. Whichever approach is taken, the first stage would consist of developing a reliable and valid questionnaire or set of observation parameters.

The second stage would consist of gathering the data using the instrument developed. This will establish a research paradigm to investigate the grounded theory of the Tribal Elder teacher and evaluate data with varimax rotation and factor analysis. The survey would also correlate the teacher practices to desired affects and attitudes in students, as measured by survey. Questions that might be considered are: Does the race of the teacher matter to the students? Does the curriculum have an impact on tribal elder teaching? Do true Tribal Elder teachers ignore the prescribed curriculum if they believe it is in the best interest of the students?

Due to the life-or-death intensity Tribal Elder teaching requires, how does a Tribal Elder teacher keep from burning out? Research has shown that 50% of the teachers new to the urban core leave within the first five years. To develop an effective

teacher under less arduous conditions takes eight years, to develop a Tribal Elder could even take longer (Waddell, 2005). This study was one case of effective teaching, for a short amount of time with highly motivated students. Ethnographic studies centered around other teachers mentioned in chapter four who have been teaching for more than five years can add important research to burnout prevention. The results of these studies could also inform educators about professional development needs.

Following up on the research of Waddell (2005) where the implied results of that research project pointed to the creation of professional learning communities within our urban schools will both increase the rates of teacher retention and provide a support group for the radical acts of teaching recommended in this research paper. A solidarity of focus with other likeminded professionals can remove that sense of being alone and remove the doubt that one is doing the right thing.

Closing Thoughts

No magic wand is available to wipe away these hellish impediments to our urban children's learning, though noble efforts at the classroom level need to continue. However, several current practices need to stop.

What needs to stop are our urban districts putting their faith and diminishing resources in canned curricula offered by textbook publishers who tout dubious statistics that supposedly demonstrate their effectiveness, especially their effectiveness with children of color. Urban district curriculum coordinators need to look "across the tracks" to the suburban districts and see if they are implementing this type of curricula. If this curriculum is not good for the privileged, it is not good for our children of color. Urban curriculum coordinators must stop the textbook publishers from cynically using the

predisposition of the dominant culture that our African American children are inferior and need special help in order to sell their wares (Hilliard, 1998). This covert exploitation by the textbook publishers to make a profit is tantamount to the ironsmiths who sold chains and shackles to the slave ship captains.

The only remedy that currently exists rests with the efforts of the individual teacher in his or her classroom. This is the only thing the teacher can control. Research indicates that teachers are the single most important factor in increasing student achievement (Waddell, 2005). It is hoped that this project provides some guidance on how to structure the classroom and how that classroom might look.

What must to stop are the demeaning practices of uniforms and metal detectors in the schools our African American children attend. None of the suburban schools I've visited have uniforms or metal detectors. These practices send a signal to our students in the urban core that they are dangerous and untrustworthy. By requiring them to wear uniforms and go through metal detectors each morning, as a society we are conditioning them for one of three things: The military,[4] fast food, or prison. Having these items in the school, or as part of the daily attire makes it that much more difficult for the Tribal Elder teacher to change the aura of the penitentiary that permeates urban schools. Having

[4] Many urban educators I've talked to seem to like the uniform policies. Some have even pointed out that I had a military career and wore a uniform, or they themselves went to Catholic schools and wore a uniform. First off, they fail to recognize that uniforms just replace one set of problems (inappropriate—let's name it; Hip Hop—attire) with another such as struggling with sagging khakis and ball caps. Secondly, I joined the military voluntarily and wore the Marine uniform as a badge of honor for something I earned—because very few have earned that privilege. Plus, everyone around me, general down to private, was in the same uniform and we all wore it with pride. The Catholic school uniform again is voluntary. A person chooses to go to a Catholic school and somewhat like the military there is a sense of pride that goes with those plaid skirts and blazers.

the courage to abandon these demeaning practices will go a long way to change the culture of the school, making it easier to change the culture of the classroom.

What needs to stop is the almost obsessive way American society focuses on arcane test scores thinking they measure anything besides how well a student can take that particular test, and this leads to educators—from teachers, to administrators, to schools of education—to stop focusing on the achievement gap. Teachers really need to ask themselves each day as they step into the classroom if knowledge of the achievement gap is really going to make them a better teacher for that day? Will it make them a better teacher for that week, or even for that year? Probably not. In fact, some research contends that knowledge of the achievement gap makes teachers predisposed to the inabilities of their children of color. Because of this predisposition they have a tendency to remediate instead of challenge (Gutierrez, 2008).

The achievement gap is simply a metric that measures the damage done to our children of color. This metric represents the racist policies of our nation over the past four hundred years and that continue today. That's what it is, and that's all it is. So, it's a worthwhile number to keep our collective eye on, but to try and close this gap by "fixing" the people who bear the brunt of this systemic racism is absurd, demeaning to the people "we" are trying to "fix", and adds to the long litany of institutionally racist policies. Approaching the achievement gap in this way is akin to "fixing" the mercury problem in salmon in the following manner: Pregnant women are cautioned not to eat salmon due to the mercury levels found in this fish. This mercury could poison the fetus and cause birth defects and even death. If we applied our methods of fixing the achievement gap to the mercury problem, we would be spending billions on trying to

develop a mercury resistant fetus. Because the salmon poisoned by our destruction of the oceans is not the problem, the problem is this unborn baby who can't handle mercury. Of course this method of fixing the mercury problem is ludicrous, and in a certain mad scientist way, diabolical. Before that baby is poisoned, there is nothing wrong with that child. Before our urban kids are "poisoned" by the schooling they have endured, there is nothing wrong with them.

This research paper began with a scene from the August Wilson play, "Radio Golf", where the uneducated but wise Sterling, is having an argument with his boyhood friend, Harmond Wilkes. Sterling used the absurd irrelevance of the mathematics lessons he received from the white teachers as a metaphor for the irrelevance of Harmond's gentrification efforts to the people still in the "blighted" neighborhood. Just like Sterling could see no use for a $12 parrot that he would just have to feed and care for, when for the same $12 he could get chickens that would feed him; the people left in the old neighborhood did not need a Barnes and Noble or Starbucks. What they needed is a decent grocery store and safe streets. Much the same is happening in the classrooms of our urban children.

Top down one-size-fits-all and dumbed down curricula, district wide benchmarks, uniforms, and metal detectors and other such schemes that would never be allowed in a suburban district, are the equivalent of putting a Starbucks or Barnes & Noble at 31st and Prospect. Like the folks in Sterling's neighborhood what the folks in our inner city need is a decent grocery store and safe streets. What is needed in their classroom is a teacher who demands academic excellence, displays a critical consciousness, and has cultural competence (Ladson-Billings, 1995). What they need is

a Tribal Elder who can teach them with a sense of urgency and high energy. They need a Tribal Elder who understands the life or death situation of the neighborhood.

Those last two sentences were not melodramatic hyperbole. In the past three weeks there have been eight murders in our urban core. Eight! They took place in the neighborhood where these children live and play and try and go to school. This is a level of violence unheard of in our suburbs. Our incoming teachers need to know the stakes they are playing with and what they are facing. When I was teaching in the urban core I'll never forget the summer they started digging up the bodies of women (the white newscasters made sure the public knew these women were prostitutes—the implied message being, that good upstanding white women don't come to this demise so Kansas City is still a safe place as long as your zip code isn't 6413x) along the Prospect corridor. This had a profound effect on my students who lived in this neighborhood. The kids were on edge, combative, and they were finding it hard to concentrate that fall. When one of the teachers in my school asked me what was wrong with the kids, they seemed almost out of control, I answered they just dug up a bunch of dead bodies in their backyards. I asked the teacher to imagine that happening in her neighborhood and how her kids would react. Or better, even how she would react! But this is the reality. Yet at the same time, these children deserve a safe place to learn and to be taught the same higher level mathematics that might help them solve their problems.

What is needed is radical acts of teaching, and they will be supported by the community. These children want to learn. The Rise Up parents I know are pro-education. Their kids want to learn, but you must accommodate as a teacher. The parents of my students in an alternative charter high school were pro-education and

weren't looking for a handout or entitlement. They were looking for "fair." They were also looking for someone who might teach their son how to avoid prison and death. The stakes are that high. As teacher educators we need to be honest with our future teachers. We need to tell them exactly what they will face and find out if they are willing to play those stakes. Unless you are willing to go “all in” where the lives of children are in the balance with each lesson you prepare, this game is just not for you.

APPENDIX A

PARENTAL/GUARDIAN INFORMED CONSENT FORM

SS11-31
Version date: 05/05/11

APPENDIX A: PARENTAL/GUARDIAN INFORMED CONSENT FORM

Parental/Guardian Informed Consent Form

April 1, 2011

Dear Sir or Madam:

My name is Robert Riggs, in addition to being your child's math teacher for the summer session of the Upward Bound Program, I am a doctoral student at the University of Missouri-Kansas City. I am writing to invite your son or daughter to participate in my doctoral dissertation research study. This research will explore the mathematical experiences of African American students who participate in my mathematics class this summer. We will be studying higher-level mathematics by introducing the students to calculus.

Your child is being invited to participate in this research study because he/she is enrolled in the Upward Bound Summer program. The data collected will be a student autobiography, examples of your child's work, my own notes and reflections. I will also be audio recording interviews at different times of the class with students. Only those students that have given their assent along with parental consent will be recorded. These recordings will only be taken at the time of a noteworthy event. Your student will not be alone during the interview, but with other students in the class and the college-aged counselors. No student identifiers will be collected or recorded, such as student names, student numbers, etc. on any of the recording or student work used for this study There will be a post-interview during the last week of the summer session. These interviews will be recorded and last about 30 to 45 minutes. Experience has shown, children tend to "open up" more in this type of interview and express more accurately their true feelings. A copy of the interview protocols and autobiography protocols are enclosed. We are expecting about 30 students to volunteer to be in the study.

Participation in this study is voluntary. You can choose for your child to not participate and, it will not affect your child in any way. The interview recordings of the instruction will be for "my ears only" and will not be shared with committee members, my adviser, or presented at conferences. I will write down conversations from the interviews but will not will use students real names, protecting the identity of the students. All data collected will be kept locked and in my office for my use only. Upon completion of the project, all recordings of students will be promptly destroyed. No personal identifying information will be used for any participants in any presentations or papers resulting from the study to assure confidentiality.

There are minimal risks and/or discomforts associated with this study. The risks and discomforts may arise because your child may be asked to discuss barriers and stereotypes they have encountered in their mathematics education. Your child may withdraw from this study at any time without further obligation. At the conclusion of the study, a summary of the results will be made available to you.

UMKC Social Sciences
Institutional Review Board
Init AB Approved From 5/11/11 to 5/8/12

Subject Initials _____

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the IRB Administrator of UMKC's Social Sciences **Institutional Review Board at 816-235-1764.**

While every effort will be made to keep confidential all of the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies) , Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions.

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about your rights as a research participant, please contact the IRB Administrator of UMKC's Social Sciences Institutional Review Board at 816-235-1764. If you have any questions about the study that you are participating in you are encouraged to call Mr. Bob Riggs, the investigator, at 816-235-2506.

Should you have any questions or desire further information, please contact my advisor, Dr. Rita Barger or me at the following:

Bob Riggs
Instructor, Physics Department
University of Missouri-Kansas City
250A Flarshiem Hall

5110 Rockhill Road
Kansas City, MO 64110
Work Phone #235-2506
e-mail: riggsr@umkc.edu

Dr. Rita Barger
Acting Chair, Curriculum and Instruction
University of Missouri-Kansas City
School of Education
Rm. 309
5110 Rockhill Road
Kansas City, MO 64110
Work Phone #:235-5565
e-mail: bargerr@umkc.edu

Sincerely,

Robert C. Riggs
Doctoral Student

UMKC Social Sciences
Institutional Review Board
Init RB Approved From 5/11/11 to 5/8/12

Subject Initials _____

SS11-31
Version date: 05/05/11

If you are willing to allow your Upward Bound student to participate, please check the appropriate statements below and sign your name. Keep one copy for your records and please use the self-addressed envelope to return one copy to Robert Riggs.

Permission for Son's or Daughter's Participation

_____ I do grant permission for my son or daughter, _____, to participate in Mr. Robert Riggs' dissertation research study.

_____ I do not grant permission for my son or daughter, _____, to participate in Mr. Robert Riggs' dissertation research study.

_____ _____

Parental/Guardian Signature **Date**

UMKC Social Sciences
Institutional Review Board
Init FB Approved From 5/11/11 to 5/8/12

Subject Initials _____

APPENDIX B

STUDENT ASSENT LETTER

SS11-31
Version date: 05/05/11

APPENDIX B: STUDENT ASSENT LETTER

Student Assent Letter

April 1, 2011

Dear Upward Bound Student,

My name is Bob Riggs, and in addition to being your math teacher for the summer session of the Upward Bound Program, I am a student at the University of Missouri-Kansas City. I am writing to invite you to participate in my research study. This research will look at the mathematical *identity* of the Upward Bound students. Mathematical identity means how you see yourself when doing mathematics. Do you see yourself as a mathematician? Is math something you just like or dislike? Has math always made you frustrated? How you answer those questions is part of determining your mathematical identity. Your school history as well as your social life determines your mathematical identity. This study will use difficult mathematics (calculus) with instruction formed by culturally relevant pedagogy and examine how it affects your mathematical identity.

This research is important because almost everything we hear about African Americans and math gives a long list of problems and shortcomings. Your participation may change that perception by showing the problems may not be with the students, but elsewhere.

This is what will happen to you during this study:

- You will be asked to write a mathematical autobiography.
- You may be asked to be interviewed. If you gave your assent and your parent/legal guardian gave their consent to be in this study, this interview will be audio recorded. You will not be interviewed alone but in groups with other students. If the interview is recorded, I will write down what was said during the interview. Some of your work this summer will be used for this study. Your name will not be linked to recordings, notes I have written down, or any of your work I use for this study. At the end of the study you will be invited to participate in a post-interview with other students. You will be asked how you felt about the math class this summer. This interview may also be recorded.

You decide whether or not to be in this study. If you do not want to participate, it will not affect you or your grade in anyway. I will make every effort to protect your privacy. Your name will not appear on any of the materials for this study if you choose to participate. No one at your home school or Upward Bound is going to read what you write. If you decide to be in the study, you will have the right to stop being in the study at any time. You will not be treated differently if you decide not to be in the study or withdraw from the study. Should you have any questions, concerns or need more information, please discuss this with your parents and either you or your parents can contact my advisor, Dr. Rita Barger, or me at the following:

While every effort will be made to keep confidential all of the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies) ,

UMKC Social Sciences
Institutional Review Board
Init BB Approved From 5/11/11 to 5/8/12

Subject Initials _____

Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions. You can contact the Institutional Review Board at 816-235-1764

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about your rights as a research participant, please contact the IRB Administrator of UMKC's Social Sciences Institutional Review Board at 816-235-1764. If you have any questions about the study that you are participating in you are encouraged to call Mr. Bob Riggs, the investigator, at 816-235-2506.

Bob Riggs
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Sincerely,

Robert C. Riggs
Doctoral Student

UMKC Social Sciences
Institutional Review Board
Init RB Approved From 5/11/11 to 5/8/12

Subject Initials _____

SSH-31
Version date: 05/05/11

If you are willing to allow your Upward Bound student to participate, please check the appropriate statements below and sign your name. Keep one copy for your records and please use the self-addressed envelope to return one copy to Robert Riggs.

Permission for Son's or Daughter's Participation

_____ I do grant permission for my son or daughter, _____, to participate in Mr. Robert Riggs' dissertation research study.

_____ I do not grant permission for my son or daughter, _____, to participate in Mr. Robert Riggs' dissertation research study.

_____
Parental/Guardian Signature **Date**

If you are willing to participate, please check the appropriate statements below and sign your name. Keep one copy for your records and please use the self-addressed envelope to return one copy to Robert Riggs.

Assent of Participation

_____ I _____(print) do want to participate in Mr. Robert Riggs' dissertation research study.

_____ I _____(print)_____ do not want to participate in Mr. Robert Riggs' dissertation research study.

_____ _____
Upward Bound Student **Date**

UMKC Social Sciences
Institutional Review Board
Init EB Approved From 5/11/11 to 5/8/12

Subject Initials _____

APPENDIX C

STUDENT INTERVIEW PROROCOLS

SS11-31
Version date: 05/05/11

APPENDIX C

Student Interview Protocols

Student Post-unit Interview

1. Do you like math class?
2. Have you always (dis)liked math class?
3. What are some the reasons for why you liked or disliked math class?
4. Is mathematics important to study? (Allow clichéd answers here as an ice breaker.)
5. Is learning mathematics important to you?
6. Why? (The students should be encouraged to go beyond clichéd answers dealing with money and finding a job.)
7. Imagine it's the first day of school and you're walking into your math class for the first time, how do you feel?
8. What actions are you going to take so that you can succeed?
9. What actions does the teacher need to take for you to succeed?
10. Describe your math class last year. (Prompting questions for this item could be:)
    a. Did you receive a homework assignment each day?
    b. Was it graded?
    c. Did the students ever work in groups?
    d. Were projects ever assigned?
    e. What resources were available to students who were struggling?
11. Do you think you will take a math class beyond geometry?
12. Do you believe people are born with mathematical ability or talent?

APPENDIX D
STUDENT MATHEMATICAL AUTOBIOGRAPHY ASSENT FORM AND PROTOCOL

APPENDIX D: MATHEMATICAL AUTOBIOGRAPHY

Assent for Student participants: Mathematical Autobiography Protocol

This explanation will be read to all student participants. An affirmative agreement must be granted before proceeding with data collection.

The purpose of the autobiography is to engage you in thinking about your experiences with school mathematics. Think back as far as you can about your experiences with mathematics in school. It is my hope you will write about things that have occurred to you relating to mathematics and school. Use the questions listed in the protocol to guide your writing. Make sure your autobiography answers all questions in the protocol. This is not a test. There are no right or wrong answers. You do not have to answer a question if you do not want to. I will assure your confidentiality.

Your parents/guardian have given permission for you to participate in this research study, but I want to make sure that this is something you want to do. If you decide you do not want to participate, just tell me. This will not affect you in any way if you do not participate. The mathematics autobiography should take about one hour to complete.

Is it okay if I ask you some questions now?

SS11-31
Version date: 05/05/11

Mathematical Autobiography Protocol

1. Identify and write about significant moments you have had with mathematics from kindergarten until now. Please include pleasant and not so pleasant moments. These moments can either have occurred in school or out of school.
    1. When were first drawn to mathematics? What interested you about it?
    2. If you weren't drawn to mathematics, what turned you off?

2. When did you first realize you were "good at math?"
    1. Describe and elaborate on this memory.
    2. How did you feel when you realized that you were good at math?
    3. Who helped you to realize you were good at math?
    4. If you believe you are *not* good at math, when did you first realize this?
    5. How did you feel when you realized that you were *not* good at math?
    6. Who helped you realize you were *not* good at math?

3. Describe the best mathematics teacher you had?
    1. What was it like to be in that teacher's class?
    2. How was this teacher different from other teachers?

SS11-31
Version date: 05/05/11

APPENDIX D: INDIVIDUAL INTERVIEW

Assent for Student participants: Individual Interviews

This explanation will be read to all student participants. An affirmative agreement must be granted before proceeding with data collection.

You have been selected to participate in this study because you are a African American student in the Upward Bound program and I will be your teacher and conducting my dissertation research simultaneously. I am interested in your school and mathematical experiences in your school. This is not a test. There are no right or wrong answers. You do not have to answer a question if you do not want to. I will assure your confidentiality. Your name will not appear on the interview protocol.

Your parents/guardian have given permission for you to participate in this research study, but I want to make sure that this is something you want to do. If you decide you do not want to participate, just tell me. This will not affect you in any way if you do not participate. The interview should take about 30 to 45 minutes to complete.

Is it okay if I ask you some questions now?

APPROVED
UMKC SOCIAL SCIENCES
INSTITUTIONAL REVIEW BOARD
INITALS EB DATE 5/11/11

APPENDIX E

RISE UP SUMMER ACADEMY MATHEMATICS CURRICULUM

Mathematics Curriculum for Upward Bound Summer Program

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Education…cannot focus on the mere transmission of obsolete content, for the most part uninteresting and useless, and inconsequential for the construction of a new society. What we can do for our children is offer them the communicative, analytic, and material instruments for them to live with a capacity for criticism in a multicultural society impregnated with technology. Ubiratan D'Ambrosio

The intent is to engage the students in a rich mathematical experience where the mathematics is both relevant to their lives and challenging. Concurrently there will be an intensive review of basic algebra skills. The summer mathematics curriculum will consist of three parts: 1) Intensive algebra review through the study of calculus, 2) Teaching mathematics for social justice.

Part A. Algebra Review through Calculus

The teaching of functions (linear, polynomial, and exponential) and how they change in relation to the independent variable (rate of change) will be the focus of this portion of the curriculum. This will provide a challenging back drop for the students to learn the beginnings of differential calculus while reviewing their algebra skills.

Week 1: Elementary functions and the line. In depth look at dependent and independent variable, practical use.

Week 2: Polynomials, graphing, max-min, inflection points, how they change.

Week 3: Composite functions, compound functions, practical use.

Week 4: "Take it to the Limit", exploring limits, graphs of where functions "disappear". Drawing functions given their equation—what does it mean?

Week 5: Taking a derivative.

Part B. Teaching Mathematics for Social Justice and Recreation (we can't be serous all the time)

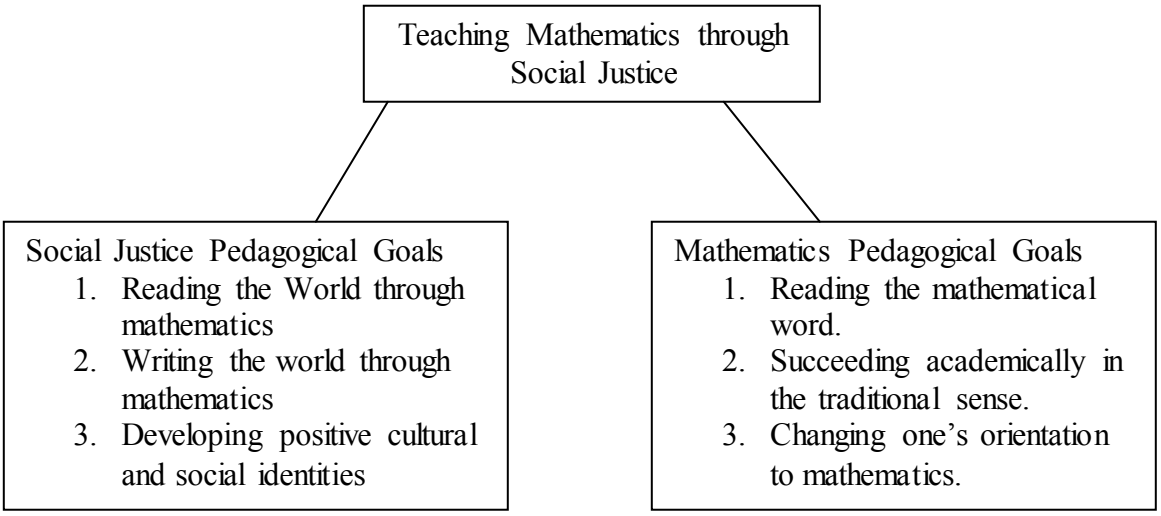
Thursdays will consist of "recreational mathematics" or "let's review the numbers" basically examining mathematics in the news. Types of recreational mathematics will be building geometric solids using gumballs and toothpicks; tracing the patterns in the Shongu Puzzles of Central Africa (and the connection to the higher algebraic concepts of Euler Circuits and Paths); and lastly making cool tessellations and art in mathematics. Two Thursdays will be dedicated to the mathematics of social justice. One thing we will examine is "What Does the War Cost?" and the just how big is the budget, who wants what? (politically), and what do the numbers say about your argument? We will then dedicate a Thursday to examining wealth distribution in the US and the world by how many Oreo Cookies do you get? The goal will be to achieve three things (Ladson-Billings, 1995):

4. Produce students who can achieve academically.

5. Produce students who exhibit cultural consciousness.

6. Develop students who can understand and critique the existing world order.

The pedagogical goals for teaching mathematics for social justice are outlined in the graphic below;



Due to the compressed time of the summer program, the desired outcome is to just "plant the seed" in the students mind how mathematics can be used to give them voice. And, just as importantly, that they *are* mathematicians.

Part C. Introduction to Ethnomathematics and Student Reflections

What is ethnomathematics?

APPENDIX F

PRE-/POST-TEST

Upward Bound Summer Academy 2011
Mathematics Pre-test

Directions: Full disclosure—this test is designed for you to fail miserably on the first go around. (If you fail this test at the end of the summer, we're gonna scrap!)

Answer each of the questions to the best of your ability. On some of the essay type questions, a simple "Yes" or "no" won't cut it. Think! Give your reasons. Have fun and good luck.

1. Draw a -7 to +7 square coordinate axis-system, then graph the following points and put I, II, III, or IV to show which quadrant it is in. If it lies on an axis, state which one:

a. (-2, 4)
b. (0, 5)
c. (2, -6)
d. (-3, -5)

2. Find the slope of the line between the following pairs of points:

a. (-3, -1) and (4, 1)

$m =$

b. (5, 2) and (-4, 2)

$m =$

c. (4, 2) and (4, -3)

$m =$

3. What is calculus?

4. Find the equation of the line that contains the points (-4, -1) and (5, 2).

5. At what values for x does the function below equal zero?

$$f(x) = x^2 - 9$$

6. At what values for x does the function below go to infinity?

$$f(x) = \frac{1}{(x-2)(x+1)}$$

7. What the heck is a *function* anyway?! (A lot of math teachers get this one wrong too.)

8. For the function $f(x) = 3x - 2$, find

a. $f(0) =$

b. $f(-2) =$

9. For the function $f(x) = x^3 - 2x + 4$ find

a. $f(1) =$

b. $f(-1) =$

10. Find $\frac{dy}{dx}$ of the following functions:

a. $y = 3x^3 - 2x + 1$

b. $y = -2x - 3$

11. The distance of a particle is defined in relation to time as; $x = 5 + 6t - 2t^2$.

a. What is the acceleration of the particle?

b. What is the function of the velocity in relation to time?

c. What is the velocity of the particle at $t = 0.5$ s?

d. What is the velocity of the particle at $t = 1.0$s?

e. Is the particle slowing down or speeding on the interval between .5 and 1 second?

APPENDIX G

SUMMER ACADEMY CALCULUS LESSONS

Lesson 1

Name_____

Finding the Slope:

1. Generate 12 more random integers, this time between -4 and +4. Record them in pairs as such:
   a. (___, ___) and (___, ___)
   b. (___, ___) and (___, ___)
   c. (___, ___) and (___, ___)
2. Plot the first two points (a. above) on the graph below:

3. Draw a line segment that connects these points.
4. Find the slope of line segment.

   m =
5. Repeat for points b. and c.

   a. m =

   b. m =

6. Did anyone have a line that was perfectly vertical?

   In this case the two _____-coordinates subtracted to = _____?

7. The slope of this type of line m =

8. Did anyone have a line that was perfectly horizontal?

   In this case the two _____-coordinates subtracted to = _____?
   a. The slope of this type of line m = _____

Lesson 2
Finding the equation of a line

1. For just a little more practice, find the slope of the line between the given points:

   a. (-2, 4) and (8, -5)

   b. (-4, 7) and (3, 0)

2. Write a sentence explaining what the slope of the line tells us.

3. In the equation $y = \frac{2}{5}x - 10$,

   a. what is the slope of the line?

   b. what is the y-intercept?

4. What IS the y-intercept? Definition.

5. Find the slope and y-intercept of the of the following equations:

   a. $y = \frac{1}{3}x + 5$ $m =$_____ $b =$_____

   b. $4x + 3y = 24$ $m =$_____ $b =$_____

   c. $-3x + 5y = -30$ $m =$_____ $b =$_____

6. Find the equation of the line through the following points.

a. (-3, 2) and (-4, 5)

b. (-4, -1) and (5, -1)

c. (2, 4) and (2, -7)

d. (1, -5) and (4, 9)

7. Finding the equation of the line using the calculator completely. Work is on the board.

#3 pg. 1 Lesson Plan July 6th, 2011

Functions. July 6, 2011 Lesson.

Domain and Range

Independent Variable Dependent Variable.

Mapping set into another set. Input, output

Review from Yesterday

Functions = one-to-one mapping, unique element from one set into another.

Domain -> x -> independent variable

Range -> y -> dependent variable.

Calculus examines the rate of change of a function. (Differential Calculus) (or qc)

$f(x) = 2x - 1$

find $f(-2) =$ $m =$

$f(1) =$ $b =$

$f(10) =$

Practice again $m =$

$f(x) = -3x - 4$

find $f(-2) =$ $b =$

$f(1) =$

$f(10) =$

Raise the level of pain. $f(x) = 2x^3 - 3x + 1$

$f(x) = x^2 - 3x + 1$

$f(-2) =$

$f(1) =$

$f(10) =$

$f(x) = -3x^3 + 2x^2 + 5x - 1$

$f(-2) =$

$f(-2) =$

$f(0) =$

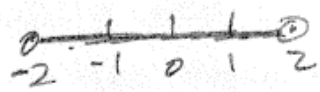
$f(5) =$

Continuous functions.

Continuous on the ~~range~~ interval $(-\infty, \infty)$ not a point.

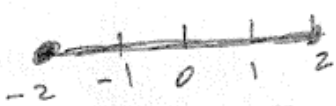
New notation.

Interval

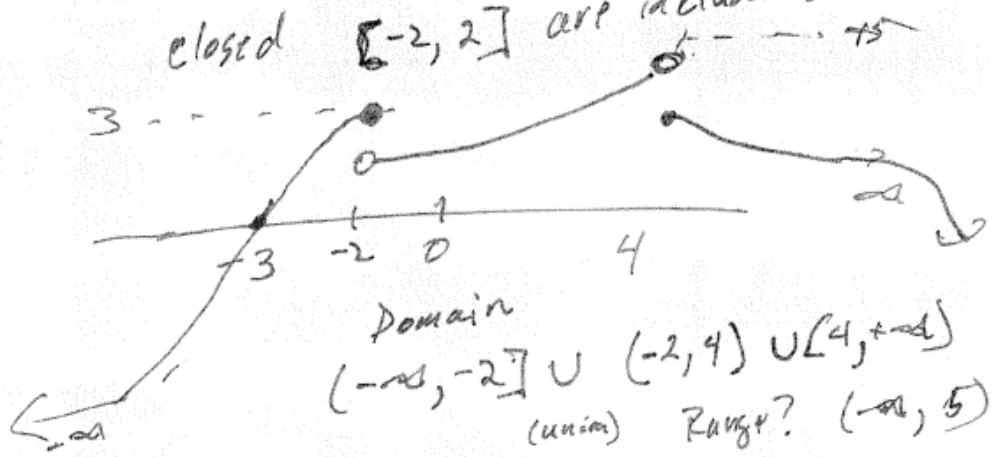


$(-2, 2)$ open. (-2 and 2 are boundaries but not in it)

~~closed~~



closed $[-2, 2]$ are included.

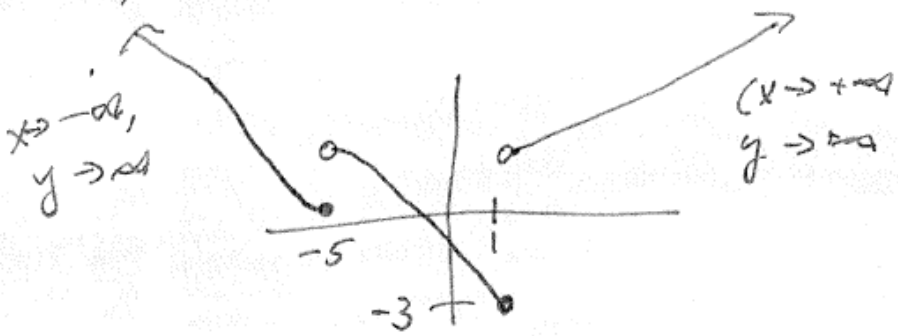


Domain

$(-\infty, -2] \cup (-2, 4) \cup [4, +\infty)$

(union) Range? $(-\infty, 5)$

Try this



Domain: $(-\infty, -5] \cup (-5, 1] \cup (1, \infty)$

Range: $[-3, \infty)$ Is it continuous?

~~Lets Graph those earlier functions~~

~~Rules~~

~~Fact.~~

One last thing on domain and range.

$Y = \sin(x)$

Domain $(-\infty, \infty)$

Range $[-1, 1]$

Graph 5x5 Window.

Earlier functions.

Change to $(-8, 5)$ window

$f(x) = \dfrac{?}{(|x-1)(x+2))}$ Xscl .5

$\frac{1}{x}$ ~~too~~ Questions about this graph.

Continuous? ~~Range?~~ Domain? Range

$(-\infty, 0) \cup (0, \infty)$

Start with $1/x$

Lesson #4

Page 1

~~Draw~~ Find the values of the following functions. for the given value of x.

1. $f(x) = 5x - 4$

   $f(-2) =$

   $f(2) =$

2. $f(x) = 5$

   $f(-2) =$

   $f(2) =$

3. $f(x) = -2x^2 + 3x - 2$

   $f(0) =$

   $f(1) =$

   $f(-2) =$

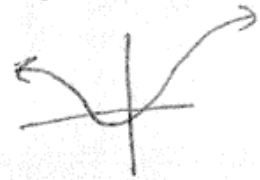
4. $f(x) = x^3 + 3x - 4$

   $f(0) =$

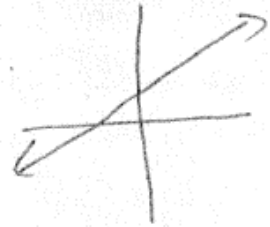
   $f(1) =$

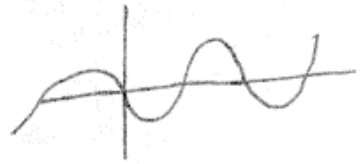
   $f(-2) =$

Circle the graphs that represent functions.

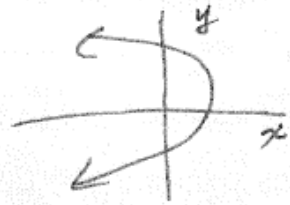
1. 

2. 

3. 

4. 

On page 1, Why was this graph:



not a function?

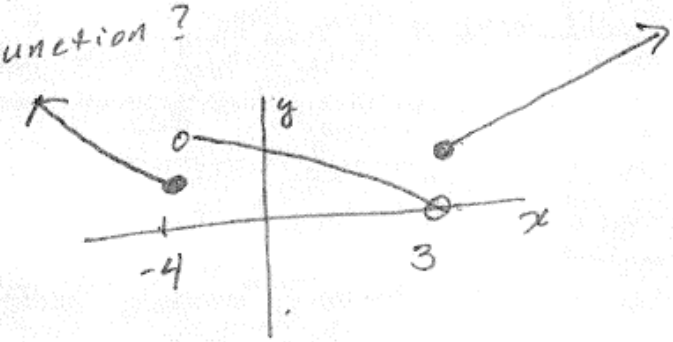
Ans: ___

II. Write down the interval of this subset of the x-axis.

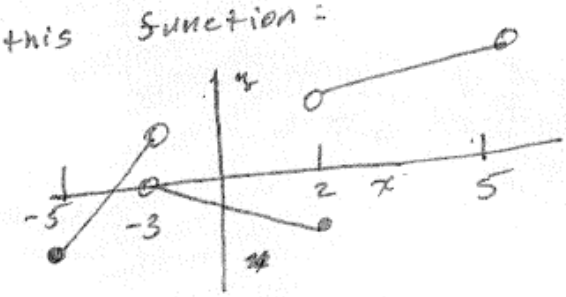
1. 

2. 

2. What is the domain of this function?



3. of this function:



Naming functions #3

Name each of these functions.

1. $f(x) = x^3 - 3x^2 + 2x - 1$ _____

2. $f(x) = -x^2 + 4x - 5$ _____

3. $f(x) = 3x^4 + 5x - 1$ _____

4. $f(x) = 3x - 1$ _____

5. All the above functions are _____

All. Graph the following functions, on your calculator.

1. $f(x) = -\frac{1}{2}x + 2$: How many zeros? ___

$f(x) = 0$ when $x =$ _____

2. $f(x) = 3x - 2$: How many zeros? ___

$f(x) = 0$ when $x =$ _____

3. $f(x) = x^2 - x - 6$: How many zeros?

$f(x) = 0$ when $x =$ ___ and ___

4. $f(x) = x^2 - 5x + 4$: How many zeros: ___

$f(x) = 0$ when $x =$ ___ and ___

Keep going. H4

1. $f(x) = x^2 + 2x + 5$ zeroes?: ____

$f(x) = 0$ when $x =$ ____ and ____

2. What happened?

3. What kind of zeros are these?

____

4. Graph $f_1(x) = -x^2 + 5x - 4$

a. How is different from

$f_2(x) = x^2 - 5x + 4$?

b. What are the zeros for both of these graphs?

$f_1(x) = 0$ $x =$ ____ and ____

$f_2(x) = 0$ $x =$ ____ and ____

#5

Cubics.

1. Graph $f(x) = x^3$ (Y_1)
   and Graph $f(x) = -x^3$ (Y_2)

   a. How are these two graphs different?

   b. How many zeros (roots) does this function have?

   $f(x) = 0$ $x =$ ___ and ___ and ___

2. Graph $f(x) = x^3 + 2x^2 - 5x - 6$

   $f(x) = 0$ at $x =$ ___ and ___ and ___

3. Graph $f(x) = x^3 + 3x^2 + 6$

   a. From looking at the graph, how many "real" root does $f(x)$ have?

   b. How many imaginary?

   c. Let's find the real root together. Got "box it in"!

H 6

Let's "box it in" and find the real roots to these functions:

1. $f(x) = x^2 + 2x - 5$

$x_1 =$ ____ $x_2 =$ ____

2. $f(x) = x^2 - 5x + 3$

$x_1 =$ ____ $x_2 =$ ____

3. $f(x) = -x^2 + 3x + 3$

$x_1 =$ ____ $x_2 =$ ____

4. $f(x) = -x^3 - 5x^2 + 3$

$x_1 =$ ____ $x_2 =$ ____ $x_3 =$ ____

Back To
Functions
Lesson #5
#1

1. Find the zero's for these functions.

a. $f(x) = (x-2)(x+2)$ No Graphing.

b. $f(x) = x^2 - 4$

c. $f(x) = (x+3)(x-4)$

d. $f(x) = (x-2)(x-3)(x+4)$

e. $f(x) = x^2(x-1)$

f. $f(x) = (x-1)^2(x+1)(x-2)^2$

2. From the functions above, which functions had repeated roots?

3. Tricky: $f(x) = \frac{1}{x}$ Graph it.

a. Does the function cross the x-axis?

b. What is the Domain?

1. More fun with LESSON #5

$$f(x) = \frac{1}{x}$$

a. What happens at $x = 0$?

2. For what values of x, do the following functions go to ~~zero~~ infinity? (or, where are they undefined.)

a. $f(x) = \dfrac{1}{x-1}$

b. $f(x) = \dfrac{1}{x^2-1}$

c. $f(x) = \dfrac{1}{(x-3)(x+2)(x-2)}$

d. $f(x) = \dfrac{x-2}{(x+2)(x-2)}$

e. $f(x) = \dfrac{x+5}{x^2-5x-6}$

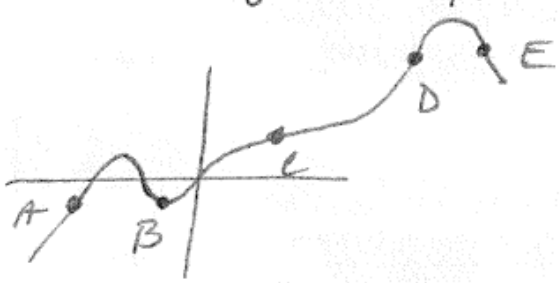
f. $f(x) = \dfrac{x^3}{x^2+2x-15}$

#3

1. Differential Calculus is used to study _____ of a function.

2. The "instantaneous" rate of change is the _____ at a certain point.

3. On the graph of the function below, draw the tangent lines at the given points A, B, C, D, & E.

a. 

b. Which slope seems steepest?

c. What can you say about the rate of change at that point?

d. Which slope is zero?

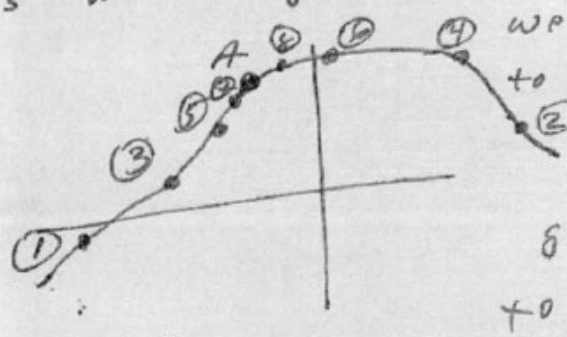
e. Draw another point where the slope is zero.

Lesson #5

#4

1. One way to find the instantaneous rate of change of a function at a certain point, (also known as the _____), is to find the "limit" of the slope of _____ lines about that point.

2. Let's work together on that.



We are going to draw secant lines until we get one close to the tangent line at A.

a. Draw the tangent line at A.

b. Draw in the secant line that connects 1 and 2.

c. Do the same for 3 and 4, 5 and 6, 7 and 8.

d. What did you observe about the secant lines?

Lesson # 5

#5

Before going further, a few definitions.

1. The slope of the tangent line of a function is called the _____ _____.

2. The symbol for the _____ _____ is _____.

3. Now let's setup the calculator so that we can find the slopes of some secant lines for a function.

Press (Window) (changing the xy-axis)

Set $X_{min} = -1.5$

$X_{max} = 1.5$

$X_{scl} = .1$

$Y_{min} = -1$

$Y_{max} = 1.5$

$Y_{scl} = .1$

$X_{res} = .1$

Set $Y_1 = -(x-1)(x+1)$

Before pushing (Graph), where is this function equal to zero ___, ___

(Graph)

Lesson #5

6

1. We are going to find some slopes of secant lines, so that we can find a "guess" for the slope at $x = -.5106$ $y = .7392$; Hit (TRACE)

a. First is the slope of the tangent line at this point, positive or negative?

b. (2) - left "Gameboy" to
$x = -.7659$ $y =$ _____

c. (2) - right "Gameboy" to
$X = .6382$ $Y =$ _____

d. Find the slope of this Secant line that joins these points.
(Hint: (and) (MODE) and work it.)

e. (2) - left "Gameboy" back to
$x = -.606383$ $y =$ _____

f. (2) - right "Gameboy" to
$x = .4787$ $y =$ _____

g. Find $m =$

Lesson #5
#7

Continue

h. (L) to $x = -.54255$ $y =$ _____

i. (R) to $x = 0$ $y = 1$

j. Find $m =$

~~Q.~~ ~~Is this~~ Let's get even closer.

(2nd) (Window) Table Set [Ask] Enter
[~~Auto~~ ~~Ask~~] Enter

(2nd) (Table)

$x = -.52$ $Y_1 =$

(V) - Down "Gamerboy"

$x = -.511$ $Y_1 =$

$m =$

Now lastly

$x = -.5106$ $Y_1 =$

$x = -.5106$ $Y_1 =$

$m =$

OOPS! What happend? _____

Lesson #5
#8

"Houston, we have a problem."
Actually, "Newton, we have a problem."

This is why we take a "limit" of the slopes of secant lines. Definition:

$$\frac{dy}{dx} =$$

Change Window to Zoom
Z-Square

$Y_1 = x^2 - 5x - 6$

Let's find $\frac{dy}{dx}$ at $x = 2$.

Using the Table.
and GRAPH

$x = 2$ $Y =$ _____

$x = 2.5$ $Y =$ _____

$\Delta x =$ _____

$m =$

still using $x = 2$ $\Delta x =$ _____

$x_2 = 2.1$

$m =$ _____

Lesson #5

#9

Continue

$x = 2.0 \quad y = -12$

$x = 2.05 \quad Y =$

$m = \qquad \Delta x =$ _____

What is happening to Δx?

One more

$x = 2.01 \quad Y =$

$m = \frac{-.01}{.01} = -1$

3. Now let's use the calculator's $\frac{dy}{dx}$ function.

2nd TRACE 6: $\frac{dy}{dx}$

$x = 1.994 \quad Y = -11.1$ ENTER

$m = \frac{dy}{dx} =$ _____ $m = ?$

2nd TRACE 6:

$x = 2.127 \quad Y = -12.1$

$m = \frac{dy}{dx} = -.744$ Is this $m = -1$?

What's happening.

LESSON #6
(#2)
RECAP

1. We have learned that the tangent line of a function gives us the _____ _____ of the function at that point.

2. The first _____ is what we call that.

3. We find the _____ _____ by finding the "limit" of the _____ of _____ lines.

4. The "hard core" math definition

$$\frac{dy}{dx} = \text{ or } f'(x) =$$

5. Today we will look at polynomial functions and their derivatives.

6. Start (by using the "hard core" definition) find $f'(x)$ of $f(x) = x^2$

(#2)

Continue

1. $f'(x) =$ _____

so

$f'(x) =$ _____

2. Now $f'(3) =$ _____

$f'(-1) =$ _____

Verify on the calculator. (comes close)

3. Whew! That took some work.

One more. Find $f'(x)$ for

$f(x) = x^2 + 5x - 6$

$f'(x) =$ _____

Lesson [illegible]

3

1. Easier way. The derivative of ~~pol~~ polynomial $f(x) = x^n$

$f'(x) =$ _____

Practice.

a. $f(x) = x^2$ $f'(x) =$ _____

b. $f(x) = 3x^2$ $f'(x) =$ _____

c. $f(x) = -2x^3 + 2x^2$ $f'(x) =$ _____

d. $f(x) = x^4 - 3x^2 + 6x - 9$

$f'(x) =$ _____

e. $f(x) = -6x^3 + 2x^2 - 3x + 4$

$f'(x) =$ _____

f. $f(x) = 6$ $f'(x) =$ _____

g. The derivative of a constant is _____.

Lesson #7
(#1)

The Physics of motion using calculus.

1. When an object accelerates, does it have a "constant" velocity?

2. Why?

3. When an object has a velocity, does it have a constant position?

4. Why?

5. Can acceleration be negative?

6. How?

7. Can velocity be negative?

8. What does that mean?

9. Can you have a negative acceleration AND a positive velocity? How?

Lesson #7
(#2)

1. In physics, acceleration is the _____ _____ of _____ of velocity.

So $\frac{dv}{dt} = a$

2. In physics, velocity is the _____ _____ of _____ of distance.

3. Let's say an object has an initial velocity of 10 m/s and an initial distance of 6 m. It is accelerating at $a = 3\ m/s^2$.
Thus the distance function, is:

$x(t) = 6m + 10t + \frac{1}{2}(3)t^2$

$x'(t) = v(t) =$

$v'(t) = x''(t) =$

4. What is the velocity at $t = 1\ s$?

5. What is the acceleration at $t = 1s$.
$t = 5s$? _____ $t = 100s$? _____

Lesson 7
#3

For now, all of our accelerations will be constant.

1. Look at the distance function

$x(t) = 200 - 15t - \frac{1}{2}(2)t^2$

$V_0 =$ _____ _____ = _____

$x_0 =$ _____ _____ = _____

$a =$ _____ _____ = _____

2. Will the acceleration change? Y / N?

3. Find

a. $V(t) =$ _____

b. $V(2) =$ _____

$x(t) =$ _____

c. $x(2) =$ _____

4. Is your answer 3.a. greater than or less than -15? Why?

5. What about $x(2)$? Is $x(2) > 200$ or $x(2) < 200$? Why?

Lesson #7

(H4)

1. $x(t) = 10t - \frac{1}{2}(4)t^2$

$x_0 =$ _____

$v_0 =$ _____ $a =$ _____

$\frac{dx}{dt} =$ _____

$x'(t) =$ _____ (same as above)

$x'(3) =$ _____

2. $x(t) = 15 + 20t - \frac{1}{2}(9.8)t^2$

$x_0 =$

$v_0 =$ $a =$ (gravity)

~~$x'(.5) =$ _____~~

$v(t) = x'(t) =$ _____

$v(.5) =$ _____

$v(1.5) =$ _____

3. $x(t) = 5 + 12t + (\frac{1}{2})(1)t^2$

$x'(4) =$ _____

$x'(3) =$ _____

APPENDIX H

GRADUATION SPEECH

It has been a great summer. It has been a pleasure and privilege to work with the Upward Bound program. There are two things that make teaching the greatest job in the world: The first is you get the thrill of watching somebody who has struggled with mathematics their whole life, suddenly cry out, "I get it!" As a teacher, you know that once a student has their first "I get it!" experience, you know they will "get it" from here on. The second thing that makes teaching so great is I get to know and then learn from my students. They don't know it, but I learn much more from them than I could ever reciprocate. And that is also very fun. In fact, teaching is so much fun I'm surprised it's legal.

Now to the Upward Bound students, let me give you a charge-or as we used to say in the Marines, a "mission." In other words, I want you to know something and then I want you to do something.

I want you to know that you are smart. In fact, I want you to know that you are more than just smart. My goodness, you all learned calculus this summer! You demonstrated what people from W.E.B. Dubois to Cornell West have known for a long time: African American children are brilliant and that they can learn mathematics. In fact there is a long history of African Americans who, despite numerous obstacles, have achieved great things in mathematics. And I'm not just talking about Benjamin Banneker.

In 1943, Euphemia Lofton Haynes earned her Ph.D. in Mathematics at The Catholic University in Washington, D.C., thus becoming the first African American Woman Ph. D. in Mathematics.

Evelyn Boyd Granville. With help from a Smith College fellowship, Granville began graduate studies at Yale University, for which she also received financial assistance. She earned an M.A. in mathematics and physics in one year, and began working toward a doctorate at Yale. For the next two years she received a Julius Rosenwald Fellowship, which was awarded to help promising black Americans develop their research potential. The following year she received an Atomic Energy Commission Predoctoral Fellowship. Granville's doctoral work concentrated on functional analysis, and her dissertation was titled On Laguerre Series in the Complex Domain. Her advisor, Einar Hille, was a former president of the American Mathematical Society. Upon receiving her Ph.D. in mathematics in 1949, Granville was elected to the scientific honorary society Sigma Xi.

Elbert F. Cox, first Black Mathematics Ph.D. Cox was awarded an Erastus Brooks Fellowship in September 1922, and he enrolled in Cornell University. When Cox's thesis advisor William Lloyd Garrison Williams (also founder of the Canadian Mathematical Society) realized that Cox had the chance to be recognized not only as the first Black in the United States, but as the first Black in the world to receive a Ph.D. in mathematics, he urged his student to send his thesis to a university in another country so that Cox's status in this regard would not be disputed. Universities in England and Germany turned Cox down (possible for reasons of race), but Japan's Imperial University of San Dei accepted the dissertation. He was the first African American to earn a Ph.D. in Mathematics

(Cornell University, 1925), just 39 years after Cornell gave its first Ph.D. in Mathematics (1886).

Abdulalim A. Shabazz--Professor of Mathematics at Lincoln University (PA).
SIGNIFICANT AWARDS

1. American Association for the Advancement of Science. AAAS presented him with the 1992 "Mentor Award" for his leadership in efforts to increase the participation of women, minorities, and individuals with physical disabilities in science and engineering.
2. He received the National Association of Mathematicians Distinguished Service Award for his years of mentoring and teaching excellence.
3. He also is a 1995 recipient of the QEM/MSE Giants in Science Award.
4. President Clinton awarded Dr. Shabazz with a National Mentor award in September 2000.
5. In 2001, the Association of African American Educators awarded Shabazz with its Lifetime Achievement Award for outstanding work with African Americans in mathematics.

The list is long, but also short. Meaning, it should be longer and I want to add your names too it. I want you tap into the rich tapestry of history and to succeed—despite what they throw at you.

The second thing I want you to know is that the Achievement Gap does not exist. The major media outlets, school officials, political leaders, colleges of education, and even some of your own teachers, want you to believe an achievement gap exists, but I'm telling you, it does not.

The only thing that exists is an *opportunity gap*.

The situation is like this: I have two farmers. I am going to test these farmers skill by seeing how much ground they can plow. That will be my test.

One farmer has a tractor and a plow. The other farmer has a hoe.

At the end of the day, the "test" is given—we look at who has plowed the most field. Why the farmer with plow. How can you argue with such an objective test? This farmer plowed more field than the other. That other farmer MUST be inferior. There is an achievement gap.

"Oh woe is me," cries the media. "Oh, woe is me," cries the administrators, the city councils, the colleges of education. "What should we do?"

"I've got an idea, let's expand the work day for the farmer with the hoe." (Longer school and mandatory summer school.)

"Brilliant." Everyone says.
The next day, they let the farmer with the hoe work much longer. (The hoe is computerized math tutors, canned curricula, and uncertified teachers.)

Once again the test is given. Te farmer with the tractor wins again.

"Oh woe is me," cries the media. "Oh, woe is me," cries the administrators, the city councils, the colleges of education. "What should we do?"

"I've got an idea—let's give this inferior farmer who obviously can't figure out how to plow this field, more hoes." (Different canned curricula, different computerized math, a new crop of uncertified teachers.)

"Brilliant!" Everyone says---so proud of themselves. "Surely with all this extra help the farmer with the hoe will do better. I mean WHAT more could he want?"

So the farmer is given more hoes, yet the farmer with the tractor still does better on the very "objective" test of how much of the field they plowed.

"Oh woe is me," cries the media. "Oh, woe is me," cries the administrators, the city councils, the colleges of education. "What should we do?"

"I know," someone says, "let's test them some more. Let's put more resources into how we measure the field and let's spend most of the school year on proper hoeing techniques. This will fix the problem."

"Brilliant!" Everyone says—everyone except the farmer who they haven't asked yet what he needs.

Well, you know the rest of the story. The farmer fails again. The results are published in the paper—everyone applauds the farmer with the tractor and everyone derides as inferior the farmer with the plow.

There is an old African saying, "If you want the elephants to grow, you don't weigh the elephants (that's testing), you FEED the elephants!" That's teaching.

Maybe someday, we'll figure out that the farmer doesn't need more canned curricula, uncertified teachers, un-air conditioned buildings, and more testing. What the farmer needs are a tractor and a plow!

That answer though is not brilliant because it costs too much money. We need to use those TIF dollars in the Northland for shopping at Zona Rosa and in the city for the night life in the Power and Light District.

Okay, maybe I've belabored the point. As Akeesha said one day in class, "I hate black white stuff, it makes me angry." Nobody likes to be angry, but sometimes anger is a motivator. Sometimes anger gives us the energy to transform things that are unjust. So here's what I want you to do: I want you to turn your anger into excellence and I want you to demand they teach you.

When they give you mediocrity at best and a computer as teacher at worst, you return excellence. You work hard with what you have.

I don't want you to retaliate with excuses, I want you to retaliate with the excellence you've demonstrated this summer.

Parents, if they give your child a computer, demand a teacher. It is work. Go to that school everyday. They have grown to count on your apathy because for thirty years, it just hasn't worked. Let's change that. Let's demand they make it work. Your kids can win this—we just have to make the game fair.

If they don't give you a real teacher, then you return that mediocrity with excellence and become a teacher yourself. If you do that, the kids behind you will have their tractor.

Now for the math awards. (Finally) It was a very tough decision. If I left you out, I'm sorry. But actually, it's because *I'm a jerk. Wa, wa wa wa wa wa.*

Top--Jeno

Improved—Koffi

Motivated—Kalan

Girls:

Top—(2) Jonisha, Niema

Improved—Trianna

Motivated—(3) Kendra, Miejoiee, Ton'yae

APPENDIX I

POST SUMMER ACADEMY SURVEY

Post-Summer Academy Survey

Key: SA: Strongly Agree **A:** Agree **N:** Neutral **D:** Disagree **SD:** Strongly Disagree

	Statement	SA	A	N	D	SD
1.	I enjoy learning mathematics.					
2.	Doing mathematics is doing something, which I think I just can't do.					
3.	I am good at mathematics.					
4.	I feel that using the graphing calculator has caused a decline in my basic arithmetic facts.					
5.	If I had a choice, I would not take anymore mathematics courses in school.					
6.	Mathematics is useful for solving everyday problems.					
7.	Calculus is too hard for me.					
8.	I am looking forward to taking more mathematics courses.					
9.	No matter how hard I try, I am not the type to do well in mathematics.					
10.	I feel confident in solving problems in mathematics.					
11.	I find mathematics very boring and dull.					
12.	I have a lot of self-confidence when it comes to mathematics.					
13.	I understand mathematics better if I solve problems using paper and pencil.					
14.	I will use mathematics in many ways as an adult.					
15.	Learning mathematics involves mostly memorizing.					
16.	I see mathematics as a subject I will rarely use in daily life.					
17.	A graphing calculator allowed me to solve problems I could not solve before.					
18.	Learning mathematics mostly involves exploring problems to discover patterns and make generalizations.					
19.	I rely on my graphing calculator too much when solving problems.					
20.	It is important to know mathematics in order to get a good job					

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VITA

Bob Riggs born on January 10, 1960 in Kansas City, Missouri. His family moved from Kansas City to Hutchinson, Kansas when Bob was three and lived out on the windy plains for seven years. Bob's interest in math and how it can be useful began at an early age when he learned how to count by twos, addition, subtraction, the fractal geometry of tournament brackets and the powers of two, assist-to-turnover ratios, average points and rebounds per game, to and handicapping basketball games by attending the NJCAA tournament near his home each year. The games were played within walking distance of Bob's house and one day during each tournament, his dad would take off work, get Bob out of school, and they would spend the entire day and late into the evening watching junior college basketball. Bob and his family moved back to the Kansas City area in 1969 and settled permanently in Liberty, Missouri.

After graduating from high school in 1978, Bob attended the University of Missouri-Columbia on a Navy ROTC scholarship. Bob majored in fraternity, keggers, and toga parties with a little mathematics (switching to math after discovering engineering was about as exciting as World Cup Soccer, or watching paint dry—take your pick). After an exhaustive five years and a threat from the NROTC commander that he would not be commissioned a second lieutenant, but rather be sent to MCRD San Diego as a private if he didn't graduate that summer. Bob got the message and graduated in 1983 as an officer of Marines.

Bob remained on active duty until 1995 where he spent eight of those twelve years overseas in Okinawa, Japan, deployed on amphibious ships in the Mediterranean

Sea and Indian Ocean, and a little jaunt across the minefields of Kuwait during Desert Storm in 1990-1991. Bob left active duty in 1995 and moved back to Liberty. He used the Troops-to Teachers program funded by the Department of Defense and Education to begin a career in teaching. He stayed in the reserves until his retirement in 2007.

Bob's first teaching assignment was in an alternative high school South Kansas City. The school was created to serve high school students who had been expelled from the regular high schools for chronic abusive, disruptive, and gang related behavior. The staff was forming and the school had not yet opened for business when Bob joined them. Bob was one of four teachers in the school. The other three teachers had well over 60 years of urban teaching experience. Bob's "schooling" now began. He was in an alternative school and obtaining his certification through "alternative" means. Bob stayed at the school for three years. During that time he learned a lot about himself, his students, and what does and what doesn't constitute "best practices" in teaching. But of all the valuable lessons he learned from these veteran teachers, from making the students accountable for their actions, to not buying into the deficit theories of why these kids are failing, to "getting over yourself" and stop trying to be the White Savior like some hero on an inane *ABC After School Special*, was that you treat all students with dignity. You treat them like fellow humans, and before long, miracles do happen. Bob was awarded the districts "First Year Teacher" of the year for the 1997-1998 school year.

When the alternative school grew and lost its focus on the kids and became just another institution, Bob joined the mathematics staff regular urban high school in the same district. He continued working on his masters while also finishing his certification. (The ghosts of "keggers" past haunted his overall GPA for certification so extra classes

were required.) After two years at the high school, Bob left and joined the staff at another alternative high school, this one a charter school in August, 2001. It was closer to Bob's home in Liberty. The school where Bob worked was fifteen miles from Liberty, yet a galaxy away. The zip code of the school is considered one of the most violent in the country. Bob stayed at this school for five years, both completing his certification and his masters. Bob was also learning for himself what worked and what didn't work with these kids. The lesson of treating them with dignity and knowing that they were capable of doing high-level mathematics served Bob and his students well during this time. Bob's teaching duties were interrupted for five months during the winter of 2003. He was recalled to active duty where he served in Kuwait and Iraq during Operation Iraqi Freedom.

During the years from 1998 to 2005, Bob held adjunct teaching positions in the math departments at Johnson County Community College and the University of Missouri-Kansas City. He taught the full gamut of freshmen and sophomore math courses, from Fundamentals of Math (also known as "In Case You Forgot Why You Hated Math" or, "Fractions and percents still Suck") to differential equations.

Bob began work on his Interdisciplinary Ph.D. in 2005. His coordinating unit is Curriculum and Instruction, with two co-disciplines in mathematics and physics. Bob joined the physics faculty at UMKC in August, 2006, where he teaches the algebra-based introductory physics courses, freshmen-level physics courses for non-science majors, and modern physics to physics majors and minors.

Bob is also the outreach coordinator for the physics department. In this capacity Bob hosts science fair days, school tours, and conducts informative visits to local high

schools and junior colleges. Bob spends the summers as the mathematics instructor for "first generation" college aspirants from the urban core as part of the Upward Bound program. He also received the Preparing Future Faculty Fellowship in 2007 and the Outstanding Dissertation Fellowship in 2009.

Bob is married to his wife Ann, and has a daughter, Megan, and two stepdaughters, Erin and Sarah.