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The purpose of this instrumental case study (Stake, 1995) was to understand (a) the impact of human resource capital on ethnic minority middle school students' engagement in a mathematics community of practice and (b) the impact of this engagement on their mathematics identities.

Case study methodology was used to collect data from nine participants. Qualitative data collection methods were used, including observations, audio taped individual and focus group interviews of participants, participants' responses to mathematics scenarios and a thorough examination of weekly journal logs kept by the participants. Data were analyzed using Creswell's (2003) content analysis coding procedures. The two themes that emerged from analysis of the data were sociocultural capital and personal capital. Sociocultural capital of the participants was demonstrated through their interactions as a mathematics community of learners including collaboration with peers, communication with peers, and the sense of community the participants perceived within the mathematics classroom [community of practice]. Other indicators of sociocultural capital in this study were participants' social networks with their peers and family members as well as their views of the relevance of mathematics in extracurricular activities and mathematics-related careers.

Participants' personal capital was demonstrated by their intrinsic motivation, including factors of self motivation and self regulation; and by participants' extrinsic

motivation, which includes the expectations of participants' families, participants' individual career goals and their prior knowledge and experiences. Implications for relevant classroom practices and further research are recommended.

# THE IMPACT OF HUMAN RESOURCE CAPITAL ON ETHNIC MINORITY MIDDLE SCHOOL STUDENTS' ENGAGEMENT IN A MATHEMATICS COMMUNITY OF PRACTICE AND THEIR MATHEMATICS IDENTITIES

by

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Approved by

____________________________________

Committee Chair

It is with the utmost sense of gratitude and gratefulness that I dedicate this dissertation to the two most influential women in my life, both of whom have led me on the path of excellence as a woman, as a student, and most importantly, as a Christian.

My late mother, Mrs. Pernella Wright Keck, always pushed me and instilled in me the desire and motivation to excel above and beyond what is expected. I will always cherish my mother's love and her famous last words to me before going home to be with the Lord: "Tracey, always strive for excellence and remember that you can do and become anything with the help of the Lord. Don't ever lose sight of your faith in God." Although my mother has gone home to be with the Lord, she left a caring, compassionate and full of love angel behind to care for me, my spiritual mother, Pastor Cheryl Ingram, whom I affectionately call, "Mom." Mom has always believed in me and pushed me to excel to my highest potential. Mom always reminds me that God let her know, "You will use this Ph.D to help other people." My spiritual mother has been so much more than a spiritual guide. She has been a true friend and confidante, a dynamic source of strength, a listening ear, a shoulder to cry on and most of all, the "wind beneath my wings." Without the power of God in her life and her many prayers, I could not have made it this far.

My completion of this dissertation is a testimony of how great God is.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro.

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# CHAPTER I

# INTRODUCTION

The National Council of Teachers of Mathematics (2000) emphasizes the role of classroom mathematical experiences in helping students gain a conceptual understanding of mathematics. Boaler (1993) suggests a shift away from abstract mathematics and towards mathematics in context as a means of reflecting on the demand of real life problems and preparing students for the mathematical requirements they will face in their everyday lives. Research indicates that project-based curricula have the potential to engage students' interests which can support them in making connections between in-school and out-of-school experiences (Jurow, 2005). From the viewpoint of Boaler (1993), "...an awareness of the utility of mathematics and its involvement in the real world is known to motivate and engage students" (p. 2). When students are allowed to become engaged with mathematics and to break down the complex concepts underlying this remote body of knowledge, they are empowered to create their own mathematical meanings (Engle & Conant, 2002).

The mathematical meanings created by students as they participate in classroom mathematical experiences may play a pivotal role in what NCTM (2000) standards define as doing mathematics. "There is a growing concern among mathematics educators that many students are able to learn mathematics for eleven years or more but are then completely unable to use this mathematics in situations outside the classroom context"

(Boaler, 1998, p. 1). Various mathematics educators (Boaler, 1998, 2000b, 2002a; Cobb, 1994; Cobb et al, 2001; Greeno and the Middle School Mathematics through Applications Group, 1998; Nasir & Cobb, 2002; Schoenfeld, 1999) conclude that students do not fully understand and use school-learned mathematical rules and procedures because of the lack of understanding resulting from how mathematics is being taught.

To encourage students' mathematical understanding, teachers must focus on the mathematical development of each child in our diverse society (Tate, 1997). As the student population in U.S. schools is becoming increasingly diverse, the number of ethnic minority students is on the rise. It has been projected that by the year 2050, African-American and Latina/o students will comprise about fifty-seven percent of all U.S. students (Howard, 2003). As a group, African American and Latina/o students perform lower on many standardized tests of academic achievement than do White and Asian American students. Following the passage of the No Child Left Behind Act of 2001, many states and districts have increased efforts to close the achievement gap. However, the disparities in mathematics achievement abound and the number of ethnically and culturally diverse students continually increases. With the shift in racial/ethnic demographics, teachers will continue to encounter students with cultural backgrounds different from their own (Gay & Howard, 2001). "Students do not just learn methods and processes in mathematics classrooms, they learn to be mathematics learners and their learning of content knowledge cannot be separated from their interactional engagement in the classroom, as the two mutually constitute one another at the time of learning" (Boaler, 2000a, p. 2). Particularly in mathematics instruction, teachers must promote a sense of engagement and belonging in the context of mathematics classrooms for ethnic minority students who are often disengaged from mathematics (Ladson-Billings, 1997). Boaler and Staples (2005) feel that students often disengage from mathematics when there is a lack of intellectual challenge as they are asked to simply memorize and execute basic routine procedures. As teachers continue to bridge cultural differences through modification of instructional strategies as well as effective communication with students, they will begin to transform their teaching methods into pedagogical practices that are culturally relevant (Howard, 2001).

Recent research suggests that, by virtue of their cultures, African American and Latina/o students possess particular preferences for learning styles or teaching approaches (Boaler, 2002b). Martin (2007) sees the mathematics literacy of African American students as being linked to a construction of identities based on the intersection between being African American (ethnic identity) and becoming a doer of mathematics (mathematics identity). Because ethnic minority students do not come into the classroom as blank slates but with human resource capital, mathematics instruction must be culturally connected (Ensign, 2003; Gordon, 1999; Martin, 2007).

Creating an environment where students can relate and interact with each other helps establish a sense of community (Boaler, 1999; Hiebert, Carpenter, Fennema, Fuson, Wearne, Murray et al., 1997). "Within mathematics education, the classroom community, including the implicit and explicit norms and practices that prevail, becomes extremely important, not as a vehicle for learning, but as an intrinsic part of the knowledge that is generated and used" (Boaler, 2000a, p. 2). Mathematics reformers favor mathematics classrooms that encourage students to adopt thinking patterns like those of mathematicians where students not only pose problems and analyze solutions to mathematical problems, but also make cultural connections to the real world through collaboration with others (Burton, 1999; Draper, 2002). In these reform-based classrooms, students use mathematical tools and manipulatives, model problems and solutions, and work in cooperative groups. When students work cooperatively on mathematical tasks, they are given the opportunity to interact, work together to search for better methods, share their solutions and listen to others. In the cooperative learning model, the focus is shifted from teaching to learning, from the individual relationship between teacher and student to the relationship of the student to the class as a community of learners. The teacher is no longer the focus of interaction. Students work in small groups and are interdependent upon each other for answers to their questions and for achieving their goals, with the teacher as a facilitator and resource. As students develop better peer relationships, they must acknowledge each others' diverse ways of knowing and doing mathematics (Hiebert et al., 1997).

Allexsaht-Snider and Hart (2001) use the term classroom processes to refer to mathematics classroom teaching and learning interactions. These processes incorporate curricular content, classroom organizational structures, instructional and assessment strategies, and classroom discourse regarding what mathematics is, how and why it is to be learned, and who can learn it. This classroom discourse takes place between teachers and students as well as among students and often includes messages about how mathematics might relate to different students' lives. They feel that students' responses to classroom interactions, such as their confidence as mathematics learners and their attitudes and motivations for learning mathematics, are key aspects of classroom processes. To analyze classroom processes and how they support equity in mathematics education, Allexsaht-Snider and Hart (2001) argue that belongingness and engagement are essential concepts. Belongingness focuses on the extent to which each student senses that he or she belongs in mathematics. This sense of belongingness can be cultivated by different aspects of these classroom processes, and becomes evident in students' sense of confidence about learning mathematics and their attitudes about participating in the community of mathematics learners (Allexsaht-Snider & Hart, 2001; Turner & Patrick, 2004). Further, the authors maintain that the concept of belongingness is an important complement to the concept of engagement as defined in the National Council of Teachers of Mathematics' *Principles and Standards* (NCTM, 2000). According to Allexsaht-Snider and Hart (2001), "the extent to which students feel they belong as members of the community in the mathematics classroom is related to how deeply and completely they engage in efforts to learn mathematics and the degree to which they find the cultural patterns embedded in classroom processes accessible" (Allexsaht-Snider & Hart, 2001, p. 98).

Students' beliefs about doing mathematics are formed by social aspects of mathematics teaching in terms of classroom social interactions. These beliefs are essential to students developing meanings with mathematics and creating connections of mathematical knowledge within those meanings (Boaler, 1993). Recent research in mathematics education focuses on socializing students into practices of the mathematics classroom as a means for allowing students to see themselves as doers of mathematics (Nasir, 2002). Boaler and Greeno (2000) define mathematics learning as a social figured world in which students engage themselves to see the connections between their perceived mathematics world and the development of their mathematics identity. These researchers look at students' low mathematical performance as a response to their rejection of mathematics during what they call a "sensitive stage" of students' identity development (Boaler & Greeno, 2000). Cobb and Hodge (2002) view mathematics identity as students' ideas about, relationships with, and participation in mathematical practices as they are realized both in the classroom and in the discipline of mathematics. For ethnic minority students, there is often a struggle to maintain a balance between positive ethnic identities (i.e. cultural factors) and strong academic identities (i.e. mathematics identities formed through engagement in a mathematics community of practice). Recent research on ethnic and academic identities documents "how some students work to do well in school by masking their ethnic selves, in the classroom, while others resist such conformity by maintaining ethnic affiliations and disengaging from school activities," (Nasir & Saxe, 2003, p. 14). In mathematics classrooms, students learn more than the mathematics, they learn what it is like to be a member of that community of practice, and whether or not they want to become engaged as participants (Lave, 1996; Lave & Wenger, 1991).

Within the mathematics community of practice, students' identities and sense of belonging originate with the experience of engagement (Wenger, 1998). It is the combination of students' cultural models of understanding, social realities, and learning strategies that constitute their identities (Gordon, 1999; Sfard & Prusak, 2005). Student learning is described as being both social and personal. The personal component involves students' human resource capital, including but not limited to students' prior knowledge [human capital], attitudes [personal capital], and cultural values [sociocultural capital] that they bring into the classroom. For ethnic minority students, who often do not have access to positive human resource capital, there is a need to support this capital with engagement as well as social interactions with others (Gordon, 1999). This engagement and interaction is instrumental in developing ethnic minority students' mathematics identities, or sense of themselves as learners and doers of mathematics (Martin, 2000; Nasir, 2002). Students' sense of themselves within the mathematics classroom is often formed from their prior in-school and out-of-school experiences and leads to the establishment of an identity within the mathematics community of practice (Cobb & Hodge, 2007; Wenger, 1988). In order to educate today's middle school students as well as increase the academic achievement of ethnic minority students, human resource capital affecting ethnic minority students' engagement in mathematics must be examined to help these students gain access to equitable opportunities for mathematics achievement.

## Purpose of the Study

The purpose of this instrumental case study (Stake, 1995) was to understand (a) the impact of human resource capital on ethnic minority middle school students' engagement in a mathematics community of practice and (b) the impact of this engagement on their mathematics identities.

## Research Questions

The following research questions guided the study:

(1) What is the human resource capital (human capital, sociocultural capital, and personal capital) of ethnic minority middle school students as it relates to mathematics?

(2) How do ethnic minority middle school students engage in a mathematics community of practice?

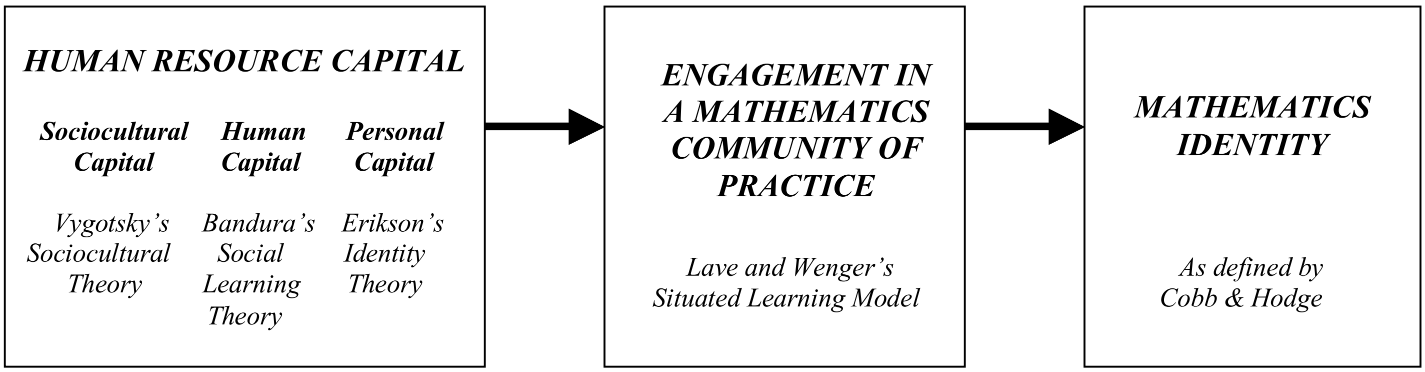
(3) What is the impact of their human resource capital (human capital, sociocultural capital, and personal capital) on their engagement in a mathematics community of practice?

(4) How do ethnic minority middle school students describe their mathematics identities?

(5) What is the impact of their engagement in a mathematics community of practice on their mathematics identities?

## Theoretical Framework

*Figure 1.* Theoretical Framework Diagram




The study was designed to understand how what ethnic minority middle school students bring culturally into the mathematics classroom in terms of human resource capital affects their engagement in a mathematics community of practice and their mathematics identities. As a theoretical framework for this study, a theory of social learning must integrate components necessary to characterize social participation as a process of learning and doing mathematics. Engagement in mathematical activities does not simply refer to social interactions among groups of people but to a more inclusive process of being active participants in a mathematics community of practice and constructing identities in relation to these communities. Specifically, in this study, I use a combination of Vygotsky's sociocultural theory, Bandura's social learning theory, Erikson's identity theory, and Lave and Wenger's situated learning model. Within this framework, individual learning is influenced by participation in classroom practices where students construct mathematical meaning as they share their reasoning (Bransford, Brown, & Cocking, 2000; Cobb & Yackel, 1995). From a social learning perspective, communication is central to learning mathematics. The types of communication in which students are involved in their mathematics classrooms influence the cultural meanings about mathematics that students develop (Cobb, 1994). For Vygotsky, students develop mathematical meanings and create their own knowledge as they learn to explain and justify their thinking to others (Vygotsky, 1994).

Vygotsky's sociocultural theory describes learning as a social process that originates in one's culture. In Vygotsky's view, social interaction plays a vital role in the development of cognition. He further believes that everything is learned through interactions with others and then is integrated into the individual's mental structure. In other words, "every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological) and then inside the child (intrapsychological)" (Vygotsky, 1978, p. 57). Another aspect of Vygotsky's sociocultural theory is the idea that the potential for cognitive development is limited to the zone of proximal development (ZPD). Vygotsky (1978) defines the ZPD as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Rather, "...what is in the zone of proximal development today will be the actual development level tomorrow -- that is, what a child can do with assistance today she will be able to do by herself tomorrow" (Vygotsky, 1978, p. 87). Through the concept of ZPD, Vygotsky (1978) determines that learning precedes cognitive development. Students must engage in learning material that consistently maintains engagement within the ZPD so that cognitive development will proceed without lapse. If a student works with learning material that is too simple or too difficult, then cognitive development does not occur and frustration often occurs. Vygotsky (1978) coined the term "social situation of development" to define how learners experience a contradiction between current abilities, individual interests, and their learning environments. Engagement in learning activities to resolve such contradictions seem to assist students in reaching their appropriate levels of cognition (Wertsch, 1985). Applying Vygotsky's ideas to learning mathematics, the growth of mathematical understanding occurs through the connection of prior learning and experiences with new mathematical language in order to create more meaning (Vygotsky, 1994).

As a complement to Vygotsky's sociocultural theory, Bandura's social learning theory focuses on learning that occurs within a social context. It considers that people learn from one another. In Bandura's view, "learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is learned observationally through modeling and from observing others" (Bandura, 1977, p. 22). Social learning theory explains human behavior in terms of continuous interaction between cognitive, behavioral, and social influences. When learning is socially mediated, as suggested by Bandura, it is cooperative, collaborative, and community-oriented. In these settings, students are encouraged to work in cooperative learning groups with other students on assignments that are both culturally and socially relevant to them. In this way, both the cooperative learning model and culturally relevant pedagogy allow the mathematics classroom to comprise a community of learners that will learn to appreciate the differences of diverse groups and to gain a degree of personal self-confidence (Howard, 2001). Students' judgments of confidence to perform academic tasks or succeed in academic activities predict their subsequent capability to accomplish such tasks (Pajares & Graham, 1999; Pietsch, Walker & Chapman, 2003; Stevens et al, 2004). According to Wenger:

> Because social learning transforms who we are and what we can do, it is an experience of identity. It is not just an accumulation of skills and information, but a process of becoming – to become a certain person or, conversely, to avoid becoming a certain person. Even the learning that we do entirely by ourselves eventually contributes to making us into a specific kind of person. We accumulate skills and information, not in the abstract as ends in themselves, but in the service of an identity. (Wenger, 1998, p. 215)

Erikson (1968) laid the foundation for research regarding identity through the development of his stage model of identity development. His idea of identity suggests two components: social and personal. In Erikson's view, personal identity is the core identity of an individual and represents the personal attributes and characteristics of a person. Social identities are constructed through the membership categories to which persons belong. In the early stages of Erikson's theory, he deems that individuals lack awareness of their own self-identities, but rather as they mature they begin to associate themselves as members of particular social groups.

Belonging to a group is seen to be a key component of a sense of self and the developing self-concept whereby members develop a keen sense of the value of the group and as a consequence derive considerable self-esteem from belonging to a particular group. Key aspects of identity involve a sense of belonging to a group; a sense of achievement within the norms of the group; and particular behaviors associated with belonging to a particular group (Erikson, 1968; Moran, 2003). The personal identities of students play an essential role in their development of mathematics identities. Personal identity deals with the notion that students identify with the activities that take place in their mathematics classes (Cobb and Hodge, 2002). Nasir and Saxe (2003) argue that cultural practices as well as socially patterned activities organized with reference to community norms and values are important for the formation of identity. From a practice-oriented perspective, it is through cultural practices that identities are shaped, constructed, and negotiated (Holland, Lachoitte, Skinner & Cain, 1998; Lave & Wenger, 1991; Martin, 2000; Nasir, 2002; Wenger, 1998). The studies of Nasir (2002) generate findings where students' engagement creates a sense of themselves in relation to activities with which they are engaged and affiliated.

As members of mathematics communities of practice experience more engagement, they develop new skills which help to create new identities. In this way, identity and learning are bidirectional (Nasir, 2002). It is crucial to understand the processes by which students develop a sense of who they are in relation to mathematics (Boaler and Greeno, 2000). Wenger (1998) argues that it is only through social processes and interactions with others that people gain a sense of self and meaning. Through studying about how students learn mathematics, they found that similarly students make sense of learning mathematics by seeing themselves as doers of mathematics. In fact, the mathematics students that they see themselves to be may be quite different from the other students in the same mathematics classroom (Lave and Wenger, 1991).

Based on the situated learning model of Lave and Wenger (1991), learning involves a process of engagement in a community of practice. According to Wenger (1998), a community of practice defines itself along three dimensions: (a) its joint enterprise as understood and continually renegotiated by its members; (b) mutual engagement that binds members together into a social entity; and (c) the shared repertoire of communal resources that members have developed over time. Rather than looking at learning as the acquisition of knowledge, Lave and Wenger (1991) seek to place learning within its social situations of co-participation. The idea of 'legitimate peripheral participation' provides a way to connect the relations between activities and identities within communities of practice to becoming a full participant in a sociocultural practice.

## Limitations of the Study

This study, while dealing with significant issues, is limited in scope. Maxwell (2005) cites reactivity and researcher bias as two of the main validity threats in qualitative research. I have served as a tutor in this school in the past so I realize that one of the validity threats of this study may be reactivity to my presence as a math tutor and participants telling me what they think will be "mathematically correct" from my perspective. To minimize this threat, I did not select students for my study with which I have had a previous tutoring relationship. In this study, I only observed one classroom in one urban, inner-city middle school in a city in the southeastern region of the United States. Therefore, the study findings may not be generalizable to all ethnic minority middle school students. Because only nine participants were used in the study, their views may not be representative of all ethnic minority students.

## Significance of the Study

In the present quantitatively complex society, a person needs a functional understanding of mathematics content to make informed decisions as a citizen. A person's mathematical disposition is related to his or her beliefs about and attitude toward mathematics and is a significant component to one's being quantitatively literate (NCTM, 2000; Wilkins & Ma, 2003). Mathematics holds a valued place in the academic curriculum. As well, it is prominent on high-stakes testing measures for determining grade-level placement, entrance into special programs, and for college admissions (Pajares & Graham, 1999). John Glenn, Chair of the National Commission on Mathematics and Science Teaching for the 21st Century (NCMST) cites four significant reasons for students to gain competency in mathematics: (a) constant change in the global economy and the American workplace; (b) daily use of math for everyday decision-making; (c) the link between mathematics and U.S. security issues; and (d) the intrinsic value of mathematical knowledge in culture (NAEP, 2005; NCMST, 2000; Patterson et al, 2003). Also, there is a need to "focus on the relation between the classroom microculture and students' developing identities. Specifically, approaches of this type would attend to the forms of mathematical activity that are realized in the classroom, to what students make of that activity, and to whether and in what ways they identify with that activity" (Cobb, Hodge & Gresalfi, in press, p. 4).

The middle school years are a critical period for American students regarding mathematics achievement and there is a need to close the achievement gap in mathematics (Holloway, 2004; Singh, Granville & Dika, 2002). As such, it is imperative to gain insights through the lens of middle school students. Nonetheless, the ways in which students characterize their engagement in mathematics and construct identities through their perspectives is not seen in current research literature. The coordination of these perspectives of middle school students along with their self-images should support researchers as they work to incorporate the sociocultural processes involved in identity into structures of cognition (Penuel & Wertsch, 1995).

For ethnic minority students, cultural orientations and social realities play a significant role in determining how they view mathematics and the mathematics classroom culture (Ladson-Billings, 1997; Moody, 2004; Stiff & Harvey, 1988). Addressing this area of research should provide insight for teachers, administrators, and teacher educators who are continually seeking strategies to decrease the low mathematics performance of ethnic minority students.

Perhaps, the data collected and analyzed from this study will offer valuable information that researchers can utilize to create a framework for improving students' engagement in mathematics for ethnic minority students who perform significantly lower than their White and Asian-American peers on standardized mathematics achievement tests (National Center for Education Statistics, 2003).

## Definition of Terms

Ethnic minority students - African- American and Latina/o students

Mathematics community of practice – According to Wenger (1998), a community of practice defines itself along three dimensions: (a) its joint enterprise as understood and continually renegotiated by its members; (b) mutual engagement that binds members together into a social entity; and (c) the shared repertoire of communal resources that members have developed over time. In this study, the mathematics classroom will serve as the mathematics community of practice and will be comprised of a community of learners engaged in activity, discourse, interpretation, justification, and reflection.

Engagement – Engagement involves learners investing themselves in a mathematics community of practice while approaching subject matter (Wenger, 1998). In this study, it will involve participation in classroom mathematical activities.

Mathematics identity – Cobb and Hodge (2002) view mathematics identity as students' ideas about, relationships with, and participation in mathematical practices as they are realized both in the classroom and in the discipline of mathematics. In this study, it will also include students' perceptions of themselves as doers of mathematics.

Human capital – What ethnic minority students bring into the classroom in terms of "social competence, tacit knowledge and other education-derived abilities as personal or family assets", (Gordon, 1999, p. xiv).

Sociocultural capital - What ethnic minority students bring into the classroom in terms of "social norms and cultural styles and values", (Gordon, 1999, p. xiv).

Personal capital - What ethnic minority students bring into the classroom in terms of "disposition, attitudes, efficacy, sense of power", (Gordon, 1999, p. xv).

# CHAPTER II

# REVIEW OF THE LITERATURE

In this study, I was interested in the impact of human resource capital on students' engagement in mathematics and how this engagement leads to the formation of their individual mathematics identities. The human resource capital that students bring into the classroom has an effect on the ways in which they engage in learning mathematics. Therefore, it is important to understand what is necessary for teachers to motivate and engage African American and Latino/a students in mathematics. This review of literature presents insights from researchers on mathematics learning for African American and Latino/a students. As well, this review offers an overview of what constitutes human resource capital, a clear definition of communities of practice, and scholarly views of mathematics identity. Each of these strands of literature play a role in addressing the research questions posed in this study.

## Motivating and Engaging Students in Mathematics

Ensuring equitable opportunities for mathematics achievement starts with the notion that all students, regardless of their race or ethnicity can learn and use mathematics (Allexsaht-Snider & Hart, 2001). Understanding the meaning of equity ensures the availability of equitable opportunities for all students within their own context (Weissglass, 2000). In support of the need for equity in mathematics, Allexsaht-Snider & Hart (2001) argue that students' engagement in the mathematics classroom is essential for fostering an equitable learning environment in which each student senses that he or she is an important participant. According to Flores (2006), because most middle school students trust the mathematical competence of their teachers, they seldom question the mathematics that is taught in school. He further explains the need for teachers to use a variety of methods when teaching mathematics concepts because not all students learn in the same way. Teachers can also foster engagement in the mathematics classroom by encouraging students to talk about their mathematical ideas. When students are given the opportunity to share and explain their thinking to teachers and peers, their mathematical abilities are reinforced (Flores, 2006).

The National Council of Teachers of Mathematics (2000) recommends a more student-centered math classroom that deemphasizes rote memorization of basic skills and facts and emphasizes problem solving and critical thinking, whereby students' mathematical capabilities can be strengthened (Draper, 2002). Brown and Walter (2005) present a traditional view of the mathematics classroom where teachers feed information to students. In response to receipt of this information, many teachers want students to simply "execute what is expected of them" (Brown & Walter, 2005, p. 14). As the authors point out, these methods fail to lead to any student understanding, independent thinking, or sense of autonomy. Teachers who encourage students to choose their own methods of solving mathematical tasks often cause students to gain a deeper understanding of mathematical content (Joyce, Weil and Calhoun, 2004). One of the major premises of problem posing is that students be allowed to think. Often, this thinking leads to the posing of more problems and to the asking of more questions.

Theoretically, students often want to clarify the right answer rather than seek different ways of looking at a problem. It is more important for students to believe and understand mathematical solutions than to merely arrive at a correct solution (Flores, 2006). It is problem posing and critical thinking as well as the connections between the two that actually lead to a deeper conceptual understanding of mathematical ideas (Brown & Walter, 2005).

In order to facilitate students' abilities to "do mathematics", the mathematics classroom community must provide rich, worthwhile, engaging mathematical activities. Engaging mathematical activities must infuse the use of relevant mathematical tools for exploring patterns, justifying reasoning, and generalizing (Henningsen & Stein, 1997). Mathematical tasks are central to students' learning and doing mathematics because they allow students to develop personal meanings regarding what doing mathematics entails in the tasks in which they are engaged (Henningsen & Stein, 1997; NCTM, 2000).

Motivating mathematics learning for students not only involves facilitating their participation in mathematical tasks, but also the process of students acquiring mathematical dispositions. Having a mathematical disposition is characterized by such activities as understanding underlying relationships of mathematical structures, making sense of and communicating mathematical ideas, thinking and reasoning in flexible ways, and deciding on whether mathematical results are reasonable (Schoenfeld, 1992). Because mathematics learning in the classroom does not occur in a vacuum, teachers should be attentive to the extent to which meaning is emphasized and the extent to which students are explicitly expected to demonstrate understanding of the mathematics underlying the activities in which they are engaged (Doyle, 1988). In a research study investigating the factors in mathematics classrooms that either hinder or support students' engagement, Henningsen and Stein (1997) found that minority students fail to engage in high-level mathematical tasks due to a lack of opportunities to participate in challenging mathematics learning experiences rather than to a lack of potential. Based on the findings of their study, these researchers encourage teachers to provide meaningful mathematical explanations where students can make relevant connections.

*African American Students and Mathematics Learning*

Particularly for African American students, they must be able to connect their learning in the mathematics classroom to real-world experiences. They must see the relevance of mathematics to their lives. The socialization processes that African American students undergo in the mathematics classroom community have a profound impact on their mathematics learning (Moody, 1998). "If we are to understand how people develop their mathematical perspectives, we must look at the issue in terms of the mathematical communities in which students live and the practices that underlie those communities" (Martin, 2000, p. 18). For African American students, there is a need for collaboration and a social learning component (Johnson & Kritsonis, 2006). Mathematics socialization describes the methods through which individual mathematics identities are shaped socially, intrapersonally and in school and community contexts. Interviews with African American students reveal that they see mathematics as a relevant subject even though they possess varied meanings and differing individual agencies. Successful students are more likely to view the instrumental importance of mathematics, express high levels of confidence in the subject, and perceive mathematics as an avenue to achieving their future goals (Martin, 2007). Martin (2000) believes that African American students must “mathematize” their experiences into real life contexts via communication, experiential learning, problem solving, cooperative learning, and focusing on multiple representations of mathematics content.

*Latino/a Students and Mathematics Learning*

The education of Latino/a students in the United States has reached a crisis stage. Although the number of Latino/a students attending public schools has increased dramatically in recent decades, Latino/a students as a group have the lowest level of education and the highest dropout rate of any group of students. There are cultural and social practices, however, that have placed Latino/a students at risk for educational failure, particularly in mathematics. Recent research emphasizes the importance of understanding the impact that these sociocultural factors have on middle school students’ educational dilemma in mathematics (Gutstein, 2006). By focusing on sociocultural context, researchers shift to a more positive interpretation of the home environment, taking into account the funds of knowledge, or collective knowledge found among social networks of households that thrive through the reciprocal exchange of resources (Gonzalez, Moll, Floyd-Tenery, Rivera, Rendon, Gonzales, Amanti, 1993) that is available within the students’ home and community. These funds of knowledge encompass the practical and intellectual knowledge gained through participation in household and community activities. These elements are essential to our understanding of what kind of mathematical experiences lead to educational success among Latino/a students (Goldenberg, Reese, & Gallimore, 1992).

The underachievement of Latino/a students has to do with current teaching practices. The most common instructional approach found in schools that serve Latino/a students is the direct instructional model. In this approach, teachers typically teach to the whole class at the same time and control all of the classroom discussion and decision making (Haberman, 1991; Padrón & Waxman, 1993). This teacher-directed instructional model emphasizes lecture, drill and practice, remediation, and student seatwork, consisting mainly of worksheets (Stephen, Varble, & Taitt, 1993). Some researchers argue that these instructional practices constitute a "pedagogy of poverty" (Haberman, 1991), because they focus on low-level skills and passive instruction. Several studies examine the classroom instruction of Latino/a students and conclude that this pedagogy of poverty orientation exists in many classrooms with Latino/as, English language learners, and other minority students (Padrón & Waxman, 1993). The consensus across research on mathematics instructional practices is that the mathematics teacher needs to provide meaningful learning experiences that are responsive to students' needs, as well as linguistically and culturally appropriate. Mathematics instruction must specifically address the concerns of Latino/a students who come from different cultures and who often are trying to learn a new language (Tharp, 1997; Tharp et al., 2000).

## Human Resource Capital

Mathematics should be a vehicle for students to deepen their grasp of the social and personal contexts of their lives. Through the process of studying their realities and using mathematics, they should strengthen their conceptual understanding and procedural proficiencies in mathematics. One of the principal ways for teachers to support students in moving toward these interconnected goals is for the students to engage in mathematical investigations within the classroom related to specific aspects of their social and physical world (Gutstein, 2006). Recent research notes that mathematics is part of a more complete system of classroom context, beliefs about self, and beliefs about the nature of mathematics (Op' t Eynde, De Corte & Verschaffel, 2006).

Gordon (1999) presents the concept of human resource capital to include such constructs as human capital, personal capital, and sociocultural capital. Human resource capital includes: (a) human capital, which is one's knowledge and educational abilities; (b) sociocultural capital, which is one's cultural styles and values; and (c) personal capital, which is one's self-efficacy and individual disposition (Gordon, 1999).

Still other interpretations exist. Gutstein (2006) refers to what people already know and bring to school with them as one component of human resource capital that he calls community knowledge. This includes the knowledge that resides in individuals and in communities that usually has been learned outside of school. It involves how people understand their lives, their communities, power relationships, and their societies. Its meaning is extended to include the emotions people encounter as well as the social and cultural knowledge people have, including their languages and the ways in which they make sense of their experiences (Coleman, 1988; Gutstein, 2006; Op ’T Eynde, De Corte, & Verschaffel, 2006).

Another component of human resource capital known as classical knowledge refers to formal, in-school, abstract knowledge. The focus of classical knowledge is to ensure that students have the competencies they need to pass all the standardized tests they will face and to have full opportunities for life, education, and career choices (Gutstein, 2006). Moll, Amanti, & González (2005) have a conception of human resource capital that they refer to as funds of knowledge. Funds of knowledge include households’ social histories, methods of thinking, and practical skills related to everyday living within communities, especially with respect to their language, and the attempts to develop instructional innovations (Moll & Greenberg, 1990). The funds of knowledge concept is the idea that every household is an educational setting in which knowledge is transmitted from the elders. The use of funds of knowledge from the home illustrates how teachers’ observations and access to community or family knowledge can be used to create successful teaching strategies in which students’ cognitive abilities and interest are used to engage them in meaningful academic experiences (Gonzalez, Andrade, Civil, & Moll, 2001; Moll, Amanti, & Gonzalez, 2005).

## Communities of Practice

Communities of practice are the prime context in which we can work out common goals through mutual engagement. The process of engagement in practice involves the whole person, both acting and knowing simultaneously. We all belong to communities of practice whether at home, school, work or while engaged in our hobbies. Communities of practice are an integral part of our everyday lives and they are altered as we go through the course of our lives. In order to understand and support learning, communities of practice are necessary. For individuals, learning involves being engaged and contributing to activities within their communities of practice. For communities, it means that learning is a process of refining and ensuring the acceptance of new members into a community of practice. The concept of practice connotes doing in a personal and social context that gives meaning to what we do. This idea includes both the explicit and the tacit, what is said as well as what is unsaid, and what is represented and assumed. Each individual has personal theories regarding how they think and behave. Communities of practice exist to allow us to develop, negotiate, and share our ways of understanding. Within a community of practice, all participants have shared responsibilities and common goals (Wenger, 1998).

The mathematics classroom is recognized as a functioning community of practice where the activities of the teachers and students are shaped by a set of norms. Learning mathematics in this environment is important for students as they become competent, take ownership of their instruction, and align themselves while engaging in this community of practice. Alignment between the practices and identities of home and school has implications for whether or not students develop ways of engagement that serve their individual goals, as well as the goals of the classroom community (Cobb & Hodge, 2002; Hand, 2003). The wide variety of mathematical practices and identities that students bring into the classroom from home are linked to competent classroom participation (Lipka, 2005; Moll, Amanti, Neff, & Gonzalez, 1992; Nasir, 2002). Participation has become an important construct in situated learning and sociocultural analyses of students' classroom experiences (Boaler, 1999; Boaler & Greeno, 2000; Cobb & Hodge, 2002; Cobb, Stephan, McClain, & Gravemeijer, 2001; Engle & Conant, 2002; Lave & Wenger, 1991; Martin, 2000). Cobb and Hodge (2002) focus on participation from an analytical perspective with regard to diversity and equity in mathematics education. They propose a relational perspective that emphasizes the relations between specific mathematics activities in which students participate in the classroom and practices within their out-of-school communities. Further, these researchers focus on the continuities and discontinuities between students' modes of discourse, reasoning, and interactions stemming from their out-of-school communities and connecting to their engagement within the mathematics community of practice (Cobb & Hodge, 2002; Wenger, 1998).

## Mathematics Identity

Though relatively new in concept, "mathematics identity" has scholars researching the connection between students' personal identities and classroom mathematics. Many researchers realize that revealing how students think of themselves in relation to math determines their persistence, interest and motivation to learn mathematics and is a central component of mathematics identity (Cobb and Hodge, 2002). Nasir (2002) defines mathematics identity as the process of identity construction through becoming a member of a community of practice. Boaler and Greeno (2000) argue that useful insights into the nature of mathematics identity can be gained from shifting the focus away from the question of ability and rather toward thinking in terms of students belonging to the community of practice (Wenger, 1998) of those who are successful at mathematics. Mathematics identity consists of the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. Further, mathematics identity encompasses a person's self understandings as well as how they are constructed by others in the context of doing mathematics. Mathematics identity is expressed in narrative form as a negotiated self, a negotiation between our own assertions and the external acknowledgements of others. As such, mathematics identities are always under construction (Martin, 2000).

Based on social learning theories, learning is a social practice where students gain a sense of self and meaning through social processes and shared experiences (Bandura, 1969). Students' feelings about mathematics cannot be separated from their experiences in lessons, but they are also closely bound to students' perceptions of the subject as very difficult and abstract, and of mathematicians as being somehow different from ordinary people. These are the starting points from which students locate themselves and are located by others as learners of mathematics. Evident in the responses of many students is the sense that there is something slightly 'special' about people who are good at mathematics (Stiff and Harvey, 1998).

Mathematics identity is based on the principles of self-efficacy and self-concept. Self-efficacy is the belief in one's abilities to organize and execute courses of action in order to achieve certain performance outcomes (Bandura, 1997). Efficacy beliefs are formed by "can" questions. For example, "Can I do this mathematical problem?" (Pajares & Schunk, 2002). Whereas, self concept is based on self-perceptions created through experience with the environment, particularly through environmental reinforcements and appraisal of others (Marsh and Craven, 1997). Pajares and Schunk (2002) conclude that self concept beliefs are formed by considering the students' feelings. Questions that reflect students' self-concept of themselves are "Am I good at mathematics?" or "How do I feel about my ability to be a good mathematics student?" (Pajares and Schunk, 2002). Therefore, self-efficacy and self-concept are fundamental principles that must be considered in order to have a clearer interpretation of mathematics identity, which deals with how students perceive themselves as learners and doers of mathematics (Nasir, 2002).

The personal identities of students play a pivotal role in their development of mathematics identity. Personal identity deals with the notion that students identify with the activities that take place in their mathematics classes. Therefore, teachers' instructional strategies would tend to impact how students perceive themselves as learners of mathematics (Cobb and Hodge, 2002). As well, ethnic minority students may view their cultural affiliation as a hindrance to mathematics identity development. One of the more widespread and persistent problems in mathematics education is that many students who are successful at mathematics often give up as soon as they fulfill basic curricular requirements. However, students who develop an identity with regard to mathematics are more likely to continue with their studies. It is crucial to understand the processes by which students develop a sense of who they are in relation to mathematics (Boaler and Greeno, 2000). Wenger (1998) argues that it is only through social processes and interactions with others that people gain a sense of self and meaning. They found that similarly students make sense of learning mathematics by seeing themselves as learners of mathematics.

The notion of identity is of paramount concern in studies of engagement within mathematics classrooms and communities of practice as a whole (Cobb & Hodge, 2002; Wenger, 1998). This engagement is closely linked to social practice and is concerned with both what is made available to individuals in the various social and cultural communities they inhabit and how they enact their engagement across them (Wenger, 1998). Wenger (1998) proposes that, “identity serves as a pivot between the social and the individual” (p. 145). The concept of identity must account for the perceptions that individuals hold about themselves and for those held by others about them, and the relations of these multiple perceptions to an individual’s social positioning in interactions. Identity captures both the histories of engagement of various sociocultural communities and institutions and the practices they develop over time, as well as the paths of individuals as they negotiate and adapt these practices across communities (Sfard & Prusak, 2005).

A number of researchers examine identity development within the mathematics classroom (Boaler & Greeno, 2000; Cobb & Hodge, 2002; Gresalfi, 2004; Martin, 2000, 2007; Nasir, 2002; Nasir & Hand, 2006; Sfard & Prusak, 2005). Martin’s (2000) research focuses on the challenges many African American students encounter as they foster positive identities as mathematics learners both inside and outside of school. He argues that while becoming doers of mathematics, these students must consider their African American identities (Martin, 2000). Nasir (2002) also looks at the relationship between identity and learning among African American youth and explores this connection across multiple activities such as dominoes, basketball (Nasir, 2002) and the mathematics classroom (Nasir & Hand, 2006).

Nasir (2002) studies the organization of social and intellectual resources for students' identity development and learning as being linked to students' goals and strategies for participation in various social practices. Drawing on Wenger's community of practice model, Nasir (2002) concludes that there is a relationship between students' goals, identities, and learning. In her view, identity formation shapes and is shaped by learning. Nasir's (2002) notion of practice-linked identity captures the sense of connection that high school basketball players develop to the practice of basketball, in contrast to mathematics. In this study, the players incorporate more of themselves as they utilize a range of available resources for participation to accomplish their play. The studies of Nasir (2002) generate findings where students' engagement creates a sense of themselves in relation to activities with which they are engaged and affiliated. Nasir argues that cultural practices as well as socially patterned activities organized with reference to community norms and values are important for the formation of identity. From a practice-oriented perspective, it is through cultural practices that identities are shaped, constructed, and negotiated (Wenger, 1998; Martin, 2000).

Current research on mathematics identity shows how identities involve aspects of both communities and learning, which both affect and reflect identity. The consideration of engagement and identity in research on mathematics learning communities shifts the focus from assessing what students know to discerning what they have an opportunity to learn within classroom mathematical practices (Greeno & Gresalfi, 2006). Opportunities to learn relate to identity in recognizing the diverse ways that opportunities can be taken up by students as a function of their cultural and mathematical experiences. Student engagement in the mathematics classroom relates to membership in particular communities as well as within interactions about positioning themselves and being positioned by others (Wortham, 2006) with respect to classroom practices. Differences in students' perceptions and engagement practices form the nature of their mathematical understandings within the mathematics community of practice (Gresalfi, 2004: Wenger, 1998).

## Summary

This review of literature reinforces the need to tap into students' human resource capital in order to better understand how they think about and learn mathematically. Students come into mathematics classroom with a wealth of valuable insights that can be helpful to their peers and teachers. Within the mathematics community of practice, there is a need for students to communicate their ideas about mathematics and to formulate their individual perceptions of themselves as doers of mathematics. As the researchers in this review suggest, there exists a relationship between social interactions and engagement in a mathematics community of practice.

# CHAPTER III

# METHODOLOGY

In this research study, I utilized a qualitative methodological paradigm. Several qualitative researchers (Bogdan & Biklen, 2003; Creswell, 2003, 2005; Denzin & Lincoln, 2003, Maxwell, 2005; Mertens, 1998; Stake, 1995, 2003) have defined qualitative research in the following ways: (a) it occurs in natural settings of the participants; (b) the researcher serves as the primary data collection instrument; (c) data emerges through the qualitative study; and (d) the focus is on the views and perspectives of the participants. Qualitative research seeks to answer questions that stress how social experience is created and given meaning (Denzin & Lincoln, 2003). Most importantly, qualitative research offers the opportunity to explore the directions that the participants and their experiences may take as well as to gain deeper understanding through natural interaction. As data and themes emerge throughout the course of the study, the "organizing concepts change somewhat as the study moves along" (Stake, 2003, p. 133).

## Case Study Design

Within the realm of qualitative methodology, I used Stakes' (1995) instrumental case study design. The instrumental case study approach studies a case that provides insight into an issue or theme (Stake, 1995, 2003). Stake (1995) believes that the instrumental case study is a bounded system and is instrumental to learning and understanding something else. The nine African American and Latino/a eighth grade participants were the bounded case in this study. Their attendance in the same school and the same mathematics classroom bound the case.

According to Stake (1995), the approach of selecting a case allows for a more intensive study, greater opportunity for learning and increased interest. The use of an instrumental case study is also significant to gaining the voice of the participants (Stake, 2003). My interest in gaining an in-depth understanding of ethnic minority middle school students' perspectives on the human resource capital that they bring into the mathematics classroom (community of practice) led to my selection of the instrumental case study approach. Further, I sought to gain the participants' viewpoints on how this human resource capital affects their engagement and mathematics identities. Specifically, in this study, I looked for insights into the participants' mathematics identities within the context of engagement in classroom mathematical activities and the human resource capital they bring to that engagement.

## Context of the Study

High Score Middle School, a middle school serving sixth, seventh, and eighth grade students, focuses on excellence in teaching and learning. The school emphasizes strong moral values, character development, and respect for diversity. The central goals of the school are to offer its students visions, role models, and tools that they can use for learning, and also for making the best choices for their lives as they approach adulthood. High Score's core classrooms are organized in three wings of the school building, each wing making up a hall. Each hall's identity and team spirit is centered on a theme.

Normally, students' core classes will meet on the same hall for all three years at the school. This atmosphere promotes ownership, teamwork, parental involvement, and a mutual school community. Each hall focuses on teaching approaches that are best suited to meet the needs of the students.

Specific features of High Score Middle School include: technology and media-based learning; problem-based instruction; Paideia seminar-based instruction; and incorporation of Howard Gardner's theory of multiple intelligences. Student development at High Score is supported and rewarded through participation in National Academic League and National Junior Honor Society. The school shares many partnerships with reputable organizations including Winston-Salem State University, Kappa Alpha Psi Fraternity, and Delta Sigma Theta Sorority.

High Score Middle School was selected as the site for the study because its student population (93% African-American and Latino/a students) represents the targeted group for this study. High Score Middle School is the ideal site because among the middle schools in its local school system, High Score has the largest population of African-American (75%) and Latino/a (18%) students (Table 1). Based on the Math EOG data for eighth grade students at High Score Middle School, 67% of the African-American students (48 out of 72) are below grade level, and 70% of the Latina/o students (32 out of 46) are below grade level (Table 2).

The classroom selected for this study was an Algebra I class which was taught by a third-year lateral entry teacher. The teacher was very organized and seemed to follow the same routine on the majority of the class sessions. Each day, she would start with warm-up exercises on the overhead projector. Students were seated at individual desks and worked independently on the problems. The students were given about 15 minutes to complete the warm-up exercises and then the teacher would go over the answers. As the teacher sat on a stool next to the overhead projector with her textbook beside her, she provided written notes on the overhead, which the students copied laboriously. Often, they would ask her to wait until they got it all copied. After lecturing in this manner, which occurred about 85% of the class sessions, students were assigned problems from the textbook to complete. While the students were completing their assignment, the teacher was either grading papers or recording grades on the computer. On rare occasions, she would answer students' questions, which were few. Instead, the students relied on each other for assistance. It was common to see the participants working together to solve the problems without the guidance of the teacher. They were in essence creating their own community of practice and developing social networks that were beneficial to their mathematics learning. Even though this teacher did not involve herself with the students on a regular basis, I observed other efforts within the school to address the students' learning of mathematics.

At High Score Middle School, they are undergoing efforts to close the achievement gap in mathematics. First of all, students who are not proficient (below grade level) in mathematics are required to come to school ten days early. During the ten-day period, these students are given an assessment to determine the appropriate levels of initial intervention. As well, the students are afforded the opportunity to set quarterly goals, receive special motivation, and any additional support necessary to assist them in becoming proficient in mathematics. The school also uses a tiered intervention system to help students who are lagging behind in mathematics. In the tiered intervention system, every three weeks, students are given an assessment correlated to the North Carolina Standard Course of Study to gauge the students' proficiency in mathematics. Teachers then focus on the mathematical areas of concern for the next three weeks. Students receive grouped tutoring during one of their elective periods. At the end of six weeks, students who are still not proficient may receive additional tutoring during a second elective period and/or after school.

Annually, at High Score Middle School, they have a Mathematics Festival that involves collaboration with eighth grade students at the school and pre-service teacher education majors from a local university. During this festival, the middle school students are exposed to mathematics games and real world mathematics activities that are aligned to state and national standards. Finally, at High Score Middle School, they have a mathematics coach who works with the teachers, evaluates mathematics EOG data, provides additional math resources, and seeks to find strategies for student improvement in mathematics.

My study will enhance these efforts because it will allow students to draw from their sociocultural capital as they interact socially in groups during the group tutoring sessions. In groups, the students can not only learn from the tutor, but from each other.

Also, the collaboration and sense of community within the mathematics community of practice as defined by the participants in the study occurs when students work in groups, help each other, and strive to reach common goals. The form of teamwork that occurs during the Mathematics Festival between the college students and the middle school students is significant to the students' learning of mathematics. These interactions also allow the middle school students to make relevant connections between real-life situations and the mathematics that they learn in the classroom.

*Table 1.* High Score Middle School Demographics
Total students: 474

| GENDER | |
|---|---|
| Male – 212 students | 45% |
| Female – 262 students | 55% |
| ETHNICITY | |
| African-American – 354 students | 75% |
| Latino/a – 85 students | 18% |

*Table 2.* High Score Middle School Eighth Grade Math EOG Data (2005-2006)

| $8^{th}$ grade students (High Score Middle School) | # of students below grade level | | # of students at or above grade level | | Total Number of Students |
|---|---|---|---|---|---|
| | Level 1 | Level 2 | Level 3 | Level 4 | $8^{th}$ grade (n=125) |
| African-American | 13 | 35 | 23 | 1 | 72 |
| Latino/a | 12 | 20 | 14 | 0 | 46 |
| White | 1 | 1 | 1 | 0 | 3 |
| Multiracial | 0 | 1 | 3 | 0 | 4 |

## Roles of the Researcher

In my experience as a mathematics educator for over ten years, I have experienced teaching mathematics in middle school as well on the collegiate level. My passion for addressing the issues in this study stems from my belief that all students can learn mathematics. In my classroom, I have continually encountered students who report that they hate mathematics and that mathematics is simply too hard. Many of these views have arisen from the human resource capital that they bring into my classroom. Some of these students have experienced ineffective mathematics teachers that led to their dislike of mathematics. Others have not been able to develop competence with mathematics and, as a result, have lost all interest in the subject. Still others simply do not see mathematics as a necessary component of their future goals. Nonetheless, I feel an obligation to study the role that this human resource capital plays in ethnic minority students' engagement in the mathematics classroom and their mathematics identities.

Stake (1995) suggests that the qualitative case researcher perform multiple roles. In this instrumental case study, I served as teacher, advocate, interpreter, and biographer. In my role as teacher in this study, I am concisely informing those who will read my research report of the issues involved in this case study. As an advocate, I am ensuring that the voices of the participants are heard by recording their comments truthfully. Stake explains the interpretive role of the researcher in this way: "It champions the interaction of researcher and phenomena. Phenomena need accurate description, but even observational interpretation of those phenomena will be shaped by the mood, the experience, the intention of the researcher" (Stake, 1995, p. 95). As such, I am providing detailed insights and interpretations of participants' viewpoints and accurately presenting their views. As a biographer, I am providing precise written accounts of what I encountered during the fieldwork including any discrepancies.

## Participants

I selected one eighth grade classroom as the community of practice at High Score Middle School. The selected classroom was representative of the demographics of the entire population of eighth grade students at the school. Among the eighth grade students at this middle school, there are 40% males, 60% females, 60% on free and/or reduced lunch, and 20% with an exceptionality including limited English proficiency. Within this school, limited English proficiency is labeled as an exceptionality. The school system in which High Score Middle School is situated is committed to providing effective and appropriate personalized education plans including diagnostic evaluations, intervention strategies, and monitoring strategies for all students with limited English proficiency.

Based on these school demographics, I purposefully selected five African-American students (three females and two males) and four Latino/a students (two females and two males) as participants. According to Creswell (2005), purposeful qualitative sampling allows for the selection of people or sites that can best help researchers understand a particular phenomenon. This type of sampling helps to (a) ensure that useful information is gained that people will learn about the phenomenon, and (b) to provide a voice to "silenced" people. The process of selecting the nine participants began with a conversation between the curriculum coordinator, the two eighth grade math teachers and myself. From this initial conversation, it was determined that one of the Algebra I classes would be best suited for the study because the time of the class would best fit my schedule. As well, the teacher of this class felt that many of the students in her class would readily provide their views on their mathematics learning. Of the sixteen students in her Algebra I class, fourteen of them were African-American or Latino/a students. The teacher allowed me to speak with these fourteen students about the study. From these fourteen students, nine volunteered to participate. These nine students became the participants in the study.

## Data Collection Procedures

Before data collection could begin, an appropriate research site had to be selected and the principal had to grant access to the site for research purposes. Gaining access into this research site involved receiving permission from the Educational Research Specialist in the school system that includes High Score Middle School. Based on the policy for research studies adopted by this school system, research projects are granted approval based on their relevance, quality, and merit. This school system's guidelines indicate that research methodology must be in the best interests of the school system. The proposed methodology must not be burdensome in terms of time and expense to the faculty, staff, and students at the research site. As well, the research methodology must be consistent with generally accepted research procedures and protocols. This school system declares that prior approval is required for any research proposal that involves the collection of data from faculty, staff, and students including collection of information from files or records, observations of students or staff, individual or focus group interviews, or written surveys.

After submitting the required documentation to the appropriate school system office and receiving approval from the school system as well as the Institutional Review Board at UNC Greensboro to conduct the study, I began my data collection. At the research site, I worked to establish good research relationships. According to Maxwell (2005), the process of initiating and negotiating these relationships is a key issue in research design. Because establishing viable research relationships is central to the overall implementation of a research study, it can have tremendous impact on a study and may enhance or hinder the various components of a research study (Maxwell, 2005). Maxwell (2005) advocates reciprocity for those involved in the study. He maintains that it is crucial to offer some form of acknowledgement. As such, I provided a lunch and plaques to the participants. To reciprocate the principal for allowing me to use her school for my research, I offered free mathematics tutorial services for her students. Once the participants were selected and agreed to participate, I arranged a meeting (under the direction of the principal) with the parents to establish consent and the participants to establish assent (Appendices A and B) and ensure confidentiality. Participants and their parent(s) or guardian(s) were informed of the parameters of the research study by an oral PowerPoint presentation (Appendix C). All consent and assent forms as well as the PowerPoint slides were presented in both English and Spanish to accommodate any Spanish-speaking students and/or parents. Data was collected for three months during the

Spring 2007 semester. As well, I conducted an initial meeting with all the participants to help make them comfortable with sharing their honest views with me. I ensured the participants' anonymity and interviewed them in a location outside the classroom. To minimize any researcher bias, I used member checking (Appendix H) to allow participants to read the interview transcripts and confirm the validity of their responses.

Data sources included observations, individual and focus group interviews, weekly journal log entries, and responses to mathematics scenarios.

*Observations*

I observed the participants in the mathematics classroom (community of practice) for three forty-five minute sessions using an approved protocol (Appendix D). However, after these observations as well as receiving feedback from the nine participants, it became clear that the teacher's style of teaching did not include any form of hands-on, interactive instruction where students were actively engaged, but rather she used a lecture style of teaching about 85% of the time. On a typical day, she would start the lesson with warm-up exercises on the overhead projector and then start writing notes on the overhead. Finally, the students would work problems from their textbook for the remainder of the class period. Thus, her teaching method did not afford me the opportunity to observe the participants being purposefully engaged within the community of practice. In other words, the teacher did not play a role in creating a community of practice within the mathematics classroom. It was the participants that created the community of practice amongst themselves. My observations of the participants interacting among themselves and forming social networks allowed me to use the observations for triangulating my data and to direct me into further interview questions for the participants.

*Individual and Focus Group Interviews*

To get a true picture of the participants' views, I conducted individual and focus group interviews. Each participant was involved in three thirty to forty-five minute individual interviews. As well, all participants were involved in three focus group interviews. For these focus group interviews, all nine participants were involved. Both types of interviews were conducted using approved interview protocols that correlate with the research questions for the study (Appendix E). The individual and focus group interviews were audio taped.

*Weekly Journal Logs*

Participants kept weekly journal logs describing their engagement in the mathematics community of practice and their views of their engagement. An approved protocol for the journal entries was used (see Appendix F). When researchers ask participants to keep journal logs of their daily activities, it provides one way to understand and describe participants and their lives. Writing is instrumental to participants telling their stories. One of the greatest benefits of writing in qualitative research is that participants actually give the researcher stories in an exact form. The words are directly from the participants and reflect their true perceptions (Mertens, 1998).

*Responses to Mathematics Scenarios*

The participants were asked to collectively create a math scenario (Appendix G) that illustrated their understanding of how mathematics is used in their figured world. Then, in individual interviews, the participants were given the opportunity to explain their personal perceptions of the mathematics observed in the scenario. Table 3 depicts the timeline of data collection and Table 4 aligns the research questions with data sources.

*Table 3.* Timeline of Data Collection

| PHASE ONE | PHASE TWO | PHASE THREE |
|---|---|---|
| April 2007 | May 2007 | June 2007 |
| Completion of informed consent forms by parents<br><br>Completion of assent forms by participants<br><br>First round of individual interviews with participants<br><br>Distribution of journal logs to participants | Second round of individual interviews with participants<br><br>First focus group interview<br><br>Third round of individual interviews with participants | Second focus group interview<br><br>Member checking session (Third focus group interview)<br><br>Collect journal logs from participants<br><br>Follow-up meeting with participants |

*Table 4.* Crosswalk Aligning Research Questions with Data Sources

| Research Questions | Theoretical Framework | Data Sources | | | |
|---|---|---|---|---|---|
| | | Individual interviews of participants | Focus group interviews of participants | Mathematics Scenarios | Journal Logs of participants |
| What is the human resource capital (human capital, sociocultural capital, and personal capital) of ethnic minority middle school students as it relates to mathematics? | X | X | X | | |
| How do ethnic minority middle school students engage in a mathematics community of practice? | X | X | X | X | X |
| What is the impact of their human resource capital (human capital, sociocultural capital, and personal capital) on their engagement in a mathematics community of practice? | X | X | X | | X |
| How do ethnic minority middle school students describe their mathematics identities? | X | X | X | | X |
| What is the impact of their engagement in a mathematics community of practice on their mathematics identities? | X | X | X | X | X |

## Data Analysis

Qualitative case study research amasses huge amounts of raw data; therefore, it is essential to maintain the data in an organized and timely fashion (Denzin & Lincoln, 2003; Merriam, 1998). More importantly, preliminary data analysis must be conducted immediately post-collection or better yet, “the right way to analyze data in a qualitative study is to do it simultaneously with data collection” (Merriam, 1998, p. 162). Stake (2003) emphasizes that data is continuously interpreted since qualitative research is inherently reflective; “in being ever reflective, the researcher is committed to pondering the impressions, deliberating recollections and records....data is sometimes precoded but continuously interpreted, on first sighting and again and again” (p. 242).

Content analysis is a research tool used to determine the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts. To conduct a content analysis on any such text, the text is coded, or broken down, into manageable categories on a variety of levels (Richards, 2005). In this study, data was analyzed from observation field notes, individual and focus group interview transcripts, journal log entries and responses to participant-created mathematics scenarios. After putting all the data (observation field notes, individual interviews, focus group interviews, journal log entries, and responses to mathematics scenarios) in a table, I went through the data and highlighted with different colors any and all common statements. From my initial analyses, about one hundred and two common statements were observed within the data. As I collapsed the data further, I was able to condense the one hundred and two common statements into twenty-four major data points. I then went though the twenty-four major data points and highlighted and color-coded common statements. These data points were then collapsed into seven indicators: (a) collaboration; (b) communication; (c) community; (d) social networks; (e) relevance; (f) intrinsic motivation; and (g) extrinsic motivation. I then compiled a list of the seven indicators and clustered them into more specific categories. The collaboration, communication, and community indicators were grouped to form the category labeled as Mathematics Community of Learners. The social networks and relevance indicators were grouped and labeled as Connections to Mathematics. The intrinsic and extrinsic motivation indicators were grouped to form the Motivation category. Then, I looked at the categories to see any further patterns. Finally, I arrived at two overarching themes: sociocultural capital and personal capital. Table 5 shows the relationship between the indicators, categories, and themes that emerged from my data analysis. See Appendix I for an example of data analysis related to the emergence of sociocultural capital.

*Table 5.* Themes, Categories, and Indicators

| THEMES | CATEGORIES | INDICATORS |
|---|---|---|
| Sociocultural Capital | Mathematics Community of Learners | Collaboration |
| | | Communication |
| | | Community |
| | Connections to Mathematics | Social Networks |
| | | Relevance |
| Personal Capital | Motivation | Intrinsic Motivation |
| | | Extrinsic Motivation |

## Validating the Accuracy of Findings

Triangulation of the multiple data sources is built into data collection and analysis for the purpose of achieving trustworthiness. "Triangulation has been generally considered a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation...triangulation serves also to clarify meaning by identifying different ways the phenomenon is being seen" (Stake, 2003, p. 241). Member checking is an important part of triangulating observations and interpretations. When participants review interview transcripts and observation field notes, they often provide valuable feedback (Stake, 2003). Participants were given the opportunity to review my interpretations of the data and sign member check documentation forms to indicate the accuracy of my interpretations to what they actually said (Appendix H).

My study can be viewed as good research because it addresses an issue where there are gaps in the literature. As well, my study addresses its purpose through clearly formulated research questions and using more than one data collection method to ensure triangulation of data. In my study, I report quotes from individual and focus group interview data to portray the true feelings and emotions of the participants. Also, my research is based on multiple perspectives from different individuals and data sources. I provide thick, detailed descriptions of people, places, and things in the study. I provide accurate accounts of experiences including any conflicts and tensions that may have arisen during the study. Finally, I offer interpretations that make comparisons to the relevant literature (Creswell, 2005).

## Summary

An instrumental case study (Stake, 1995 & 2003) was utilized to examine the role that human resource capital plays in the engagement of African American and Latino/a middle school students in mathematics as well as the impact of engagement within their mathematics class on their mathematics identities. Data sources for this study included: three observations of the nine participants in the mathematics community of practice, three individual interviews per participant, three focus group interviews with the entire group of nine participants, weekly journal log entries, and participants' responses to mathematics scenarios created by the group. The data gathered in the study were analyzed using content analysis. Two major themes emerged from the data analysis: sociocultural capital and personal capital.

# CHAPTER IV

# RESULTS

## Introduction

The purpose of this case study was to understand (a) the impact of human resource capital on engagement in a mathematics community of practice for nine eighth grade African American and Latino/a students who were currently attending High Score Middle School in the southeastern region of the United States, and (b) the impact of this engagement on their mathematics identities. The study was designed to explore how students' out of school experiences, relationships with family members and friends, and personal motivations influence their mathematics learning and sense of themselves as doers of mathematics.

I studied the participants in the natural setting of their school. Two themes related to human resource capital emerged from analysis of the data: sociocultural capital and personal capital. Related to these two themes are three categories: (a) mathematics community of learners, (b) connections to mathematics, and (c) motivation. Indicators of the mathematics community of learners are collaboration, communication, and community. Connections to mathematics was influenced by participants' social networks and perceived relevance of mathematics. Motivation includes both intrinsic and extrinsic motivation. This chapter presents the results of my data analysis, beginning with profiles of the nine students.

## Participant Profiles

### *Ashley*

Ashley is a fourteen year old Latina female. She is relatively quiet, but seems pretty confident. She is very attractive and dainty. She lives with both parents and her two younger brothers. She lives within walking distance of High Score Middle School and has many friends in her math class. She was observed working very diligently and always completing assigned work. She did have a slight attendance problem and would be absent at least once every ten days. She is apparently very close to her mother because she spoke of her on a regular basis. She loves playing soccer and is not sure of her career path for the future.

### *Carlos*

Carlos, a thirteen year old Latino male is very soft spoken. Most times, I would have to probe and probe and probe to get him to respond. Surprisingly, once he did speak, the responses were always meaningful. Carlos is very intelligent but not very sure of himself. He never felt like he was a good math student. He was always very mannerly and respectful. He was a jewel to all his teachers and received "Student of the Year" for his team. He was involved in a group called "Achievement through Partnership" sponsored by Kappa Alpha Psi Fraternity for high achieving boys in the school. Carlos is a very talented pianist. I look for him to be the next Mozart. He lives with both parents and two younger brothers. He does not understand English very well but he tries and works hard in school.

*Chad*

Chad is a fourteen year old African-American male. He is just a cool guy and very popular. He is very sociable and always has a crowd of people following him. He is always very well dressed and seems to have a new jersey and new pair of sneakers every week. Chad is not only a ladies' man but an all-around athlete. He could make some remarkable sports-related analogies to mathematics. He is a computer whiz and wants to be a professional athlete in the future. He is very close to his mother and older sisters who he says "spoil" him.

*Christian*

Christian is a thirteen year old social butterfly and very mature for her age. She is a Latina female with a Latina mother and African American father. She lives for her two younger brothers whom she spends a great deal of time caring for. Christian is very, very sociable, articulate, and outgoing. She is the type of student that all teachers call on to run errands without having to worry about her goofing off in the hall. As her pseudo name indicates, she is a Christian girl and is often seen reading her Bible in her spare time. She told me she had read the entire Bible all the way through three times this year.

*Jayceona*

Jayceona is a fourteen year old African American female. She is very bright and competitive. In her math class, she is always the one to finish first and is eager to help others. She maintains the highest average in her Algebra class. She admits that she does not mind helping others understand the math, but she does not want anyone to surpass her average. Jayceona loves band and playing the flute. She is involved in the Big Sister program and plays softball with her big sister. Also, she is an excellent basketball player and wants to join the WNBA someday. She is very outspoken and loves to eat. She lives with her mother and her older brother whom she adores. Her father is a very influential factor in her life and has encouraged her to do well to secure a future where she becomes independent. She aspires to be an attorney in the future. She is going to be an excellent one because of her verbal and written skills.

*Nicee*

Nicee, a fourteen year old African American female, is simply just so sweet. Every time I saw her, she would run up and give me a hug. She is a kind and friendly person. She is best friends with Nicole and was always with her. She is a great dancer and performer. She says she loves math and it comes easy to her. She lives with her mother and spends a lot of time with her entire family on the weekends. She always comes back on Mondays telling us how much fun she had over the previous weekend. She is not exactly sure of her future career path but she is sure it will be math-related.

*Nicole*

Nicole is a thirteen year old African American female and future pediatrician. She is very talkative but helpful to her peers because her learning curve is extremely fast. She loves math and playing math games. She lives with her grandmother whom she loves dearly. She helps her grandmother cook, clean, paint, and lay carpet. She spends a lot of time with her best friend, Nicee. She is involved in a lot of extracurricular activities in the community and in the summer. Nicole says she can't wait to get to high school to see all her friends from the community. She loves fried chicken and shrimp alfredo. She is easily bored and says if a class gets too quiet and she loses interest, she will fall asleep quite easily. She loves shopping and spending money so she has to become a pediatrician to support her spending habits.

*Santana*

Santana is a thirteen year old African American male. He is a little on the quiet side except for in the cafeteria because he loves eating. He is proud to be in Algebra I and in the top group. He says he started out the year being a little slack but he got tired of his grandmother putting him on punishment so he got his act together. He is athletic as well and plays football and basketball. He likes to shop and play video games. He strives to do well in school to win the approval of his father. He loves band and plays the trumpet.

*Xavier*

Xavier is a fourteen year old Latino male from Peru. He has been in the United States since fifth grade. He does not like the lack of structure in our schools. He says in his native country, schools only teach academics and there are no elective classes. Both of his parents are school administrators so he has no choice but to do well. He loves playing soccer and playing the saxophone in band. He is a part of "Achievement through Partnership" sponsored by Kappa Alpha Psi Fraternity. He works hard and is very laid back and cool. He is an attractive young man and very respectful. He thinks he may want to be an engineer or computer programmer in the future.

## Sociocultural Capital

My initial meeting with the nine participants at High Score Middle School in April, 2007 was during what I call a "shooting the breeze" session. At this session, the participants were given the opportunity to tell me anything they wanted about themselves. It was a time for us to get to know each other. During the session, several factors were clear to me. First of all, this is quite a social bunch. They are very close and extremely talkative. They do, however, express themselves in a very articulate manner and are very direct in expressing their feelings, likes, and dislikes. I could see that most of them are friends, live in close proximity, and take classes together. As well, almost all of them seem to have a need for social interactions and to communicate their thoughts. In other words, they have a lot of sociocultural capital.

Students' sociocultural capital is a property of individuals and is based on both social interactions and cultural influences. Sociocultural capital refers to connections among individuals including their social networks, norms of reciprocity, and the trust that arises from them. The definition of sociocultural capital is extended in this study to include the active connections among people, which covers the trust, mutual understanding, and shared values and behaviors that bind people as members of social networks and communities of practice. Within learning communities of practice, there is a common social resource that facilitates information exchange and knowledge sharing built on continuous interaction (Coleman, 1988; Wenger 1998).

*Mathematics Community of Learners*

Evaluating the context of learning in relationship to sociocultural factors is an important consideration as it relates to mathematics classroom instruction. From this perspective, not only are students taught mathematics curriculum, but also a "hidden curriculum" that reveals sociocultural factors, including social norms, roles, and social class (Brand, Glasson, & Green, 2006). In this study, there is a strong correlation between sociocultural capital and interactions within the mathematics community of learners that is reflected through the participants' collaboration, communication, and sense of community as well as their social networks and how they see mathematics as relevant to their lives.

As I visited these participants in their Algebra class, I observed them in what appeared to be a small community. In this setting, everyone is working collaboratively, discussing the mathematics lesson, creating their own methods for doing the mathematics, and helping each other. Although they often arrive at their solutions in different ways, they communicate their ideas to each other and all seem to want the others in their groups to "get it." The combination of their collaboration, communication patterns, and sense of community among one another led to the perception of them as a mathematics community of learners.

Collaboration

In this study, collaboration includes students working in groups and assisting each other in solving mathematics problems. Within this collaborative setting, students not only use each other as a resource but also use their textbooks and graphing calculators to help facilitate their mathematics learning. There was a great deal of collaboration within the participants' mathematics community of practice. Many participants cited that they enjoyed working in groups. Ashley particularly liked working in groups because she felt that, "if she needed help with something, her peers could help her and if they needed help with something, she could help them" (Ashley, Individual Interview, April 23, 2007). This form of give-and take is another characteristic of collaboration as defined in this study. Additionally, Chad feels that, "if he know there's somebody in the group who can help him, it's better with him because he can learn something from them and they can learn something from him. Also, they can also tell him how he may be messing up" (Chad, Focus Group Interview, May 16, 2007). In Santana's words, "working with my friends helped me a lot" (Santana, Journal Log Entry, Week of April 23, 2007). Nicee went on to say:

> Well, I could not have made it through math this year without group work because I had a hard time understanding my teacher but the way my group members broke it down made it easy for me. Overall, I learned that it's okay to seek help from others since we are all working to learn and achieve a passing grade.
>
> (Nicee, Journal Log Entry, Week of May 28, 2007)

Carlos feels that group work is good, but sometimes, there are cultural and language barriers that can hinder the success of the group. He says,

> Some people like to work together. Others don't because they don't get along together. It's because of races. Some people in the class don't like Latinos and some Latinos don't like all black people. If you don't like a person, you can't work well together in a group. Sometimes, because some of them don't get what the teacher is saying or what it means so they have to go over and over it again. Cause they fail the tests because they don't understand the math language. Pair them with someone who speaks Spanish and understands better. That will help a lot.
>
> (Carlos, Individual Interview, May 15, 2007)

While Carlos perceived some possible barriers within group work, Christian took pride in her ability to bring everyone together. In her opinion, "I think I have good leadership skills and I think I can get everybody together on the same page to the point that I learn something and the whole group learns something as well. I think I'm a people person" (Christian, Focus Group Interview, June 4, 2007). Also, the participants were striving to help each other to become successful within the mathematics community of practice. For these participants, it is important for the whole group to learn something. For example, Nicole feels that, "it was not enough for it to be easy for me. I wanted my best friend in the class to catch on too. I learned how to reach back and help someone else" (Nicole, Journal Log Entry, Week of May 21, 2007). Jayceona mentioned, "I want to help others. Sometimes in my math class I see others struggling and I feel the need to help them out"

(Jayceona, Focus Group Interview, June 4, 2007). Xavier explained that "I like my math class because everyone is always working together, sharing ideas and discussing" (Xavier, Journal Log Entry, Week of May 21, 2007). In Xavier's view, one of the most positive aspects of his mathematics class was collaboration. because it reminded him about his native country. In his words,

> Sometimes, we work in groups and help each other. That reminds me of my country because when we work as partners, we all want to get a good grade. In my country, everyone worked together and strived to be the best at everything.
>
> (Xavier, Individual Interview, May 15, 2007)

<u>Communication</u>

Most of the participants in this study felt the need to communicate. In this study, communication occurred in the participants' view when they were discussing their ideas about mathematics, providing individual insights about mathematics lessons, and sharing their views of doing mathematics. Xavier felt that "he became more confident this year in math class by how they discussed their answers in groups and came to an answer as partners" (Xavier, Journal Log Entry, Week of May 7, 2007). As well, Ashley believed that communication was necessary for mathematics learning. As she put it, "when we work in groups, everyone must communicate and that helps because if somebody doesn't understand or get it, the talking with all of us in the group might help them see it or catch on" (Ashley, Journal Log Entry, Week of May 21, 2007). Not only should students be able to communicate with each other, but also "teachers must be able to communicate mathematics to the students in a way the students can understand" (Christian, Journal Log Entry, Week of April 30, 2007). As well, Christian feels motivated to learn if she can talk to her teachers and get to know them. She remarked:

> I like to talk to them and get to know them. Like I think I can talk to them and most of the time I think I can trust my teachers, and if I don't have that, at least I can hold a conversation with them. I believe that has a lot to do with it because if you don't know your teacher and you don't want to know your teacher, you're not going to want to listen to what they have to say either.
>
> (Christian, Individual Interview, May 7, 2007)

The social learning component of this mathematics community of practice allowed for a great deal of mathematics discourse. Jayceona expressed that,

> The social environment in my math class was very good because we all like to talk. Mostly, we get in trouble for talking but the talking helps us to discuss our ways of solving the problems and come up with the answer together.
>
> (Jayceona, Journal Log Entry, Week of May 28, 2007)

Furthermore, Nicole says, "we talk a lot in math class and that helps because it makes us explain our learning" (Nicole, Journal Log Entry, Week of April 23, 2007). Students have a need to communicate and even though most of the time, these participants could not grasp the mathematics from their teacher because of her lecture style of teaching, they could understand it from each other.

As Nicee reiterated:

> We have a good social environment in our math class because we like to chat a lot but also we enjoy working together to make sure everybody is learning. Personally, most of us don't get it when the teacher explains it but when someone our own age breaks it down, we can more easily get it. (Nicee, Journal Log Entry, Week of April 30, 2007)

Community

There was a clear understanding of community within their mathematics classroom. For the participants, a community is a place where people get along or at least have a good working relationship. In their community, there were shared visions of achieving at a high level. Everyone worked in unity and all participants were committed to making sure everyone experienced success in the mathematics community of practice. In contrast to collaboration where students mainly work in groups, a community is a place where students take ownership. Community is more than just working in concert but rather it involves a sense of belonging within a close-knit family of, in this case, learners and doers of mathematics. In this study, within the mathematics community of practice, participants were working as a team with common goals and all striving to do well. In other words, all of the participants had each others back. The participants were able to personally see how their mathematics classroom functioned as a community. Santana was able to see the characteristics of a community within his mathematics class.

He commented:

> In a community, people work together and most people like each other and do things together. Well, we work together in math class and we have fun together and play games. When we talk and interact together, it helps us learn the math better because we are all trying to do well and we encourage each other.
>
> (Santana, Individual Interview, April 26, 2007)

As well, Christian added the fact that:

> It's good for everyone in math class to be friends so we can always go to each other for help when we need it. So, social relationships in math class are very important. I think middle school students thrive on being social and fitting in with their classmates, much like a community.
>
> (Christian, Journal Log Entry, May 21, 2007)

Also, Chad discussed the connection between his community at home and the mathematics community within his classroom. He says:

> When we work in groups and play games, we have fun together just like in our communities at home. In math class, you get to choose your own groups sometimes. Working in groups both at school and at home is helpful because you learn stuff from each other. Both communities get closer by interacting with each other. It's like a small group of close people who get together and have cookouts, play backyard football, basketball and go to parks and the recreation center. We interact and

have fun together.

(Chad, Individual Interview, May 15, 2007)

Both Nicee and Christian expressed the importance of being team players in the mathematics community of practice. Nicee stated:

> This year in math class, I learned that I was very good to work with…a team player I guess because I was open to others helping me and I was always eager to help others if they needed me to.
>
> (Nicee, Journal Log Entry, Week of May 21, 2007)

Christian also mentioned:

> I don't think it mattered which classmates we were paired with, we were just like a family and that sense of community is what pushed us to help each other. We all wanted each other to succeed. So most of all, I learned this year in math how to be a team player.
>
> (Christian, Journal Log Entry, Week of May 28, 2007)

Finally, Jayceona expressed her frustration when the community structure is not maintained, both at home and in school. She maintained:

> Some communities act like a family and have togetherness and work together. Other communities are just out of control. They have kids outside at all times of the night doing things that they shouldn't. In these communities, the kids are trying to be adults before their time. Outside of school, in my community, if I need help with something, I know to ask my friends. In the math classroom, if I need help working on a certain

> problem, then I can ask one of my classmates to help me with it and then, eventually, I will learn how to do it myself in both communities. Sometimes, my classmates can be out of control. They can be bad or act rudely to the teacher. Like yelling at the teacher for no reason and they know they are wrong, but they mostly do it to impress their friends. It takes us longer to learn the math concepts when the math classroom is out of control because the teacher concentrates on those students who are misbehaving. So, they are actually hindering our learning.
> (Jayceona, Individual Interview, May 15, 2007)

*Connections to Mathematics*

Participants described their connections to mathematics in terms of social interactions with others and their perceived relevance of mathematics in activities in which they were involved. These connections involved more than an awareness of mathematics-related activities, but students were able to tie what they learned outside of the mathematics classroom to specific mathematical topics and how the two are interrelated.

<u>Social Networks</u>

It was important for the participants to develop social networks and they explained how these networks are related to their mathematics learning. Their social networking occurred with participation in mathematics-related activities with their family and friends. Many of the participants spoke of their love for shopping. Ashley especially enjoys going to the store with her mother. She explained how they use math in their shopping:

> Like, um, like when I see my mom. She goes, like, every week...she goes...she has every bill to see how much she's going to pay for them and everything. When we go to the store and if you only have like, only twenty dollars, and want to buy this and that, you have to figure out how much you can buy.
>
> (Ashley, Focus Group Interview, May 16, 2007)

As well, Jayceona connects her mathematics learning to working with her mother. She reiterated:

> My mom has this checking account and a checkbook. She showed me about adding deposits and subtracting withdrawals. This helped me in seventh grade when we learned rate of change. She like helps me use the order of operations. I have to like multiply like her money before I can subtract stuff from it. So I can see actually where her net income is that day. Because my mother had already exposed me to calculating money, I was able to easily grasp the concept in my math class because I could really see the connection.
>
> (Jayceona, Focus Group Interview, June 4, 2007)

Nicole and Nicee also learned mathematics by interactions with their parents.

In Nicee's words:

> My parents helped me learn to count money because we went to the grocery store a lot and they would let me figure out how much money we

> should get back and sometimes the better buys. I think this relates to working backwards to solve math word problems and also guessing and checking. Also, washing clothes, I learned how to measure the amount of detergent I would need for different sized loads of clothes. As well, when I help my mom cook, I need to know exact measurements so the food will be good.
>
> (Nicee, Focus Group Interview, May 16, 2007)

Nicole added:

> At home, I help my grandma. A couple weeks ago, we had to measure the floor. They were putting down new carpet. So we had to measure the floor. I used to watch my grandmother cook and she would show me exactly how to measure the correct amounts of ingredients for the food and using the measuring cups was like using fractions. I learned if we were going to cook less, we would have to divide the fractions.
>
> (Nicole, Focus Group Interview, June 4, 2007)

Both Chad and Christian , who are both very social, have a great deal of connections with family members and friends. As well, they use mathematics in church. Chad mentioned:

> When I'm on the computer. OK, like, I am on this thing called My Space. When you be on there, you try to find your specific friend, you have to add up the miles, like, how far they live away from you and stuff like that. Then like sometimes when I be arguing with my sisters, we...they be like "add it up, add it up" and I can actually do it in my head and they be like looking' around for a pen and a piece of paper. Sometimes like that or

> anything we be arguing about that has to do with, like, numbers and stuff. Like money and stuff. Like...I think I'm always right. But they be trying' to tell me I'm wrong when I know I'm right. And I don't like that. Like percentages. When we are in church, I have to give percentages. When I be adding' up the people to see how many come this day, how many come that day. Uh, when I go to the movies on the weekends with my cousins. Sometimes we be like getting' my uncle with money. When he is like, when we call him and ask him. We are like we need twenty-one dollars. Like it's four of us...no it's two of us and it cost five dollars to get in the movies, but we said twenty-one dollars. Actually it is seven but when we add it all up it is twenty-one. We all have extra money to get something. (Chad, Focus Group Interview, May 16, 2007)

Further, Christian said:

> Uh, I do have to know a lot of math because I usually get held holding, watching my brothers all the time. And uh, so I make them dinner and stuff and I need to know how long to put stuff in there and how long to take it out and with all that, I use my math. And if I go to the store and I only have a certain amount of money because sometimes when I teach at church, they give me love donations and when they give me money, I have to know can I buy my brothers a snack and dinner because they like snacks and I like being nice like that. Even though I tell them I'm not going to, I always have a little place where I give them something. But, I

> always have to know if I get this do I have a couple of dollars to spend on this? And it plays a big part even at church for ten percent…I'm supposed to give ten percent of all my earnings to the church before I do anything else. So, when I do get money, even big sums of money, I make sure that if I either give ten percent or I give more.
>
> (Christian, Focus Group Interview, May 16, 2007)

Relevance

In the study, the participants felt that mathematics had a great deal of relevance in their lives. In fact, they commented on many different areas where they use what they learned in the mathematics classroom in their activities outside the mathematics classroom. Many of the participants spoke of the athletic activities and the connections to mathematics in those activities. Xavier makes this connection:

> I use my math skills when playing soccer. For example, you've got a rectangle which is the goal and you've got to score on that so you must measure the angle to kick the ball and the speed and the time limit to make the score. When I'm playing soccer, calculating how the ball is going to get in the goal. Like, I say, you measure and that gets in your mind for the next day you'll be ready. Math is usually measuring, calculating and estimating.
>
> Like, in practice I measure the square...the goal square and my foot...where I'm going to kick it at and then where it's going to go. Then if it gets to the point I want it to then that's right. If it doesn't then I'm going to keep trying and trying

> till I do it. Math class is the same thing. If I don't get the answer right, I'm just going to keep trying and trying until I get it right.
>
> (Xavier, Focus Group Interview, May 16, 2007)

Ashley, who also plays soccer, commented:

> I played soccer. Um, it's fun because you get to play with your friends. From the time I practice like, um, I just like played with my brother, like practicing, but just playing at the same time. Since he like to play too, so we just play and when it was like the real game, I just focus on that and not think about anything else. Well, first, they try to get the ball to the other end, the goal. Well you can shoot...score and the one who gets the most points is the one who wins. You supposed to just kick, not use your hands and pass it your partners and not let the other team get it. Well, maybe, yes because like when you're about to score, you have to know how far to kick or how slow so you can score. Measurement. Like try to figure out how many feet or how many yards away like from you to see how far you're going to kick the ball.
>
> (Ashley, Focus Group Interview, May 16, 2007)

Chad, who is very athletic, could make some outstanding connections with his athletic experiences and the mathematics he learned in his mathematics classes. First, he says:

> It's statistics in sports. So they got to do numbers and percentages and all that. Baseball cards. Like with a baseball card you can do probability. Like football cards...the scores at basketball games. Like, you score this amount

> of points in this quarter, and then you score this amount of points in this quarter. Then throughout the whole game...you add all your points up to everyone else on your team then you scored that percentage out of a hundred out of your whole team.
>
> (Chad, Focus Group Interview, June 4, 2007)

Chad then speaks of his basketball experiences:

> Math is involved in scoring points in basketball…threes and twos. You've got to be able to add to take score. It's like counting by threes and twos in math. You can also get triples and doubles. If you get more than ten points and more than ten assists in a game, that's a double-double. If you get ten points, ten assists and ten rebounds, that's a triple-double. You can also get a quadruple-double. It's like a quadrilateral in math with four sides. You can see math in the shot clock, too. In college, they get more time to shoot the ball than in the pros. In the NBA, you get 24 seconds to shoot the ball. If you don't shoot in the 24 seconds, the other team gets the ball and it's a shot clock violation. The Bulls use a triangle offense…they use geometry. They cut through the lines in a triangular pattern. Somebody goes to the baseline and somebody else cuts for the free throw line or the three-point line.
>
> (Chad, Focus Group Interview, June 4, 2007)

Santana adds:

> Sometimes, I went to the recreation center and played basketball with my friends. Well, in scoring or calculating the points, you can count by ones or twos

> and threes. Like, when you shoot inside the perimeter or do a lay up then you get two points. The perimeter on the basketball court is like a semicircle. It reminds me of something I learned in math in the geometry section.
>
> (Santana, Individual Interview, April 26, 2007)

Chad not only made the connection between his athletic experiences and mathematics, but also in the mathematics scenario created by the participants, Chad was able to see the relevance of mathematics in playing basketball. He reiterated that:

> The story emphasized a lot of percent of change. When the story is talking about shooting three pointers that involves angles. When I shoot three pointers, I always shoot from an angle. My favorite angle is from the corners of the court because it seems like then the ball goes directly into the basket. This relates to what I've learned in math class about angle relationships and estimation because I can usually make a good guess at the best angle to shoot to make the basket. I particularly like learning about Pythagorean Theorem with right angles and hypotenuses. If I am standing on a basketball court, that forms a right angle and if I shoot at an angle then a hypotenuse is formed. Playing the lottery relates to using probability and chance.
>
> (Chad, Response to Math Scenario, May 29, 2007)

Also in playing football, Chad could make connections with mathematics. In his words:

> I played football. I was the star running back until fifth grade when I got hurt. I thought I wasn't going to ever play again. In football, I played

> running back, linebacker, and quarterback. The running back gets the ball and runs the ball. The quarterback passes or throws the ball. The line backer is like the captain on defense. They called me "Little Emmitt" because they said I used to play like Emmitt Smith. Yes, in remembering the holes…like odd and even. It's like 1, 3, 5 and 7 are the different holes you've got to run into if you're a running back. On the right side, it's like 2, 4, 6, 8.
>
> (Chad, Individual Interview, May 15, 2007)

Most of the participants were involved in music classes: band, piano, chorus, or dance. In elective classes, the participants presented great analogies of how they use mathematics. Santana explained:

> Well, I take band and there is a lot of math in playing an instrument. When we are counting our rests, you count quarter rests as two beats or you can have a whole note which is worth four beats. You also have to know when to stop just like in math, you have to know when you have solved a problem enough and have gotten the final answer. You have to read the music like you have the read the question carefully in math problem solving.
>
> (Santana, Focus Group Interview, May 16, 2007)

Carlos expressed the importance of counting beats when playing the piano. He commented, "when I play the piano, I must count beats and know when to start and stop. Also, the angle at which I sit is important because if I don't sit right, I cannot play right"

(Carlos, Focus Group Interview, May 16, 2007).

Xaxier added:

> Time signature is like four fourths…like the fraction four over four which equals one whole. When I first learned to count my time signatures, I recalled how I had learned fraction relationships in elementary school and that helped a lot. Other fractions are used too like two quarters …two over four or six-eighths…it really depends on the musical composition.
>
> (Xavier, Focus Group Interview, June 4, 2007)

Additionally, Jayceona said:

> I'm also in band. Another way we use math is when we count our time signatures which is the number of beats per measure and when we play, we must calculate how long to play so the other people in the band know when to come in and play. We need to know exactly when to start and stop or the song will be messed up. I think about timing also when taking math tests. I have to pace myself so that I get through all the problems or my grade will be messed up. To add on to what Xavier said, with the time signature, there are four beats to a measure. Like, four over four equal to one whole so that tells you that four beats are equal to one measure. In dance, when we are doing pyramids, we must spot and check our angles for watching other dancers so we don't run into other dancers. We have to count beats in dance class too like in band.
>
> (Jayceona, Focus Group Interview, May 16, 2007)

Nicee related the mathematics used in band to the mathematics used in chorus. She explained:

> In chorus, you must count the beats like in band. Counting beats relates to fractions. In my computer class, we use a great deal of math. We do spreadsheets and databases. We have to enter formulas to calculate information in the data and our knowledge from our math classes helps us to know how to use the formulas in our computer classes. In dance class, spotting helps you move to the correct position when doing a dance routine. It helps you to make sure you are going in the right direction. It's like forming a line in math. You have to plot points on the horizontal x-axis and then on the vertical y-axis and use the slope to determine the way the line will be drawn. If we move the correct way in a dance routine, it makes our steps appear smoother. When groups are dancing, we need to know when to come in on queue.
>
> (Nicee, Focus Group Interview, May 16, 2007)

Christian, too, spoke about dance and the mathematics involved. She remarked:

> A lot of math was involved. Like in dance production, you have to know, what time to come out, how many steps you were to take to come out, which wing you come from, and you have to add all that stuff up. Because the counts on every step are counted, like we do eight counts on every step, like the step team. Step had lots of counts, like, 1...2...3...4...1...2...3...4, and they ask how many steps did you

> take, sixty-four steps. And like singing, you have to know what notes to hit and what time, and it had a lot to do with math. Mainly, it's adding and subtraction, dividing and stuff like that. I learned a lot of word problems. For instance, my dance teacher used to use me as an example. If I made you take ten steps to the west wing, and then go up stage four steps, then where were you going to be on the stage? And then I would have to remember and divide, because then I have to take steps back, because your upper level is different from lower. Up and back is way different, and so that is what I related it to.
>
> (Christian, Individual Interview, May 7, 2007)

In addition to music elective classes, many participants were enrolled in video production and physical education classes where they talked about how mathematics was emphasized. In Xavier's view:

> The camera we use in video production to take pictures involves measurement of angles to get the right animation. You look at the picture as a rectangle and we have to calculate the best angle to shoot to get the best coverage.
>
> (Xavier, Focus Group Interview, June 4, 2007)

Christian added:

> Yeah, a formula is mainly how you calculate or find something different with some given variables or amounts. We use formulas a lot in my video production class. When we are filming, we use the cameras and we have

> to determine the angle for the camera, the time to start and stop production and when filming actors, we must know that amount of headroom to get and how much sound to include. I remember learning angles and calculating them with the protractor.
>
> (Christian, Focus Group Interview, May 16, 2007)

Nicole related physical education to learning mathematics. She remarked:

> In PE, we use math to calculate our distances in running and to see how many pounds to lose and counting our carbohydrates and the amount of food per serving that we eat. We use formulas like distance equals rate times time to calculate the distance we run around the track. I remember learning that formula in math class in the sixth grade and other formulas like area, perimeter, and temperature conversions.
>
> (Nicole, Focus Group Interview, May 16, 2007)

These participants were well aware of mathematics-related careers and the requirements for these careers. Xavier stated:

> Because math is usually, like, used in any career you want to be like an engineer or an architect. Like, you know, how they do construction for a building. They have to add and stuff like that you know. Just following the plans, he got to know a lot to measure.
>
> (Xavier, Individual Interview, April 25, 2007)

Both Nicee and Jayceona have a love for math and can easily see its relevance to their lives.

Nicee said:

> Math is awesome. I love math. ‘Cause it’s easy for me to understand and I get it just like that. Plus, numbers is my thing. Yes, it’s very important because my dad was explaining to me one day about how different kinds of jobs require math skills and that’s a lot of jobs that you need math for. Um...like if you know you want to do construction work like my dad, you need to know all about math. Teachers, of course, they need to know math. Those are the only two I can think of now. They need to have exact measurements of certain things to make a house or building. They need to know exact measurements.
>
> (Nicee, Individual Interview, May 7, 2007)

As Jayceona put it,

> I love math. I think if you’re going to succeed in life, you’re going to have to do math. Every job you want to do in life involves some kind of math in it. Like...if you want to be a bank teller. If you want to work at a fast food restaurant...if you want to work at the cash register...if you want to be an accountant...if you want to be a lawyer or construction worker where you would have to know the different measurements of the houses or the things you’re building. Well, accountants, I think, they, like help you manage your money. A construction worker, they use like a tape measure so they can find out what measurement is what so they can know how to put the houses together or how to build whatever they are building. So

> they can know the exact points. So they can make it exactly how the person they are working for wants them to make it.
>
> (Jayceona, Individual Interview, April 26, 2007)

Many participants could see the relevance of mathematics to them personally within the mathematics scenario. Although the participants created the scenario collectively, each had a different perspective about the mathematics involved. For Nicole, she commented:

> In the math story, we talked about two girls going to Golden Corral and they had to use math to calculate how much it would cost and if it was half price, that involves multiplying and I learned the percentages in sixth and seventh grade. Once you learn the basic steps in math, you can do it.
>
> (Nicole, Response to Math Scenario, May 29, 2007)

For some of them, cell phone usage is a significant part of their lives so they could readily see the connections between cell phones and mathematics. Ashley felt that, "a lot of math is used in everyday situations for me. "With my cell phone, I have to keep a count of my minutes so I don't go over the limit and my mom takes my phone" (Ashley, Response to Math Scenario, May 29, 2007). Chad, too, expressed his thoughts about cell phone usage, "In the story, using my cell phone reminds me of fractions and percentages because when I use text messaging, the phone lets you know in numbers how much space is left as a percent of the screen" (Santana, Response to Math Scenario, May 29, 2007). Finally, there were participants who realized the importance of mathematics in everyday life and as a means of being successful in life. For Carlos, " I think math is important because I think; you use it in every day life. Like a businessman or maybe computers. To calculate money. Maybe, how much memory they can put in the computer" (Carlos, Individual Interview, April 23, 2007). Ashley added, "Like, I think in every job you have to always need numbers. You use numbers in every job you have" (Ashley, Individual Interview, April 23, 2007).

Nicole presented her view of the relevance of mathematics as well. In her words,

> Like you use math a lot in the world. Like, different jobs, different occupations. Architect. I used to want to be an architect. You have to use like adding. You have to get your measurements right and stuff like that and like, in the medical field, you have to give like the exact amount of medicine for different ages. So you could use it in different ways to help people, and stuff like that so...I really like...I love math. Accountants use math. They count money, and I love to shop. I like money. So math, is important to me.
>
> (Nicole, Individual Interview, May 7, 2007)

## Personal Capital

Personal capital is a kind of human capital because it relates to a capacity embodied in individuals. However, personal capital differs from standard human capital in that the human capacity involved is not the type developed by academic education or by the usual types of job-related training. The personal capital capacities are fundamentally different from cognitive intelligence or intellectual knowledge. Personal capital relates to an individual's basic personal qualities and reflects the quality of an individual's motivations and psychological, physical, and spiritual functioning (Tomer, 2002; Tomer, 2003). Further, it mirrors one's internal biochemical balance, physical health and conditioning, psychological strengths and weaknesses, and purpose in life. A person's stock of personal capital is a product of one's genetic inheritance, partly a result of the life-shaping events that one has encountered, and partly an outcome of one's efforts to mature and to grow in nonintellectual ways.

*Motivation*

Traditional theories of motivation characterize motivations as reasons that individuals have for behaving in a given manner in a given situation. These motivations tend to focus on both mastery goals and performance goals. Mastery goals include understanding, high achievement, and mastery of academic content. Performance goals center on students' obtaining favorable judgments of their competence from teachers, parents, and peers or on avoiding negative perceptions of their competence. Traditional motivation theorists believe that students who are intrinsically motivated engage in academic tasks because they enjoy them. These students seek out learning opportunities for the sheer joy of learning. Further, these theorists purport that students who are extrinsically motivated engage in academic tasks to obtain rewards or to avoid punishment. Researchers have found that achievement, ability, and perceived competence each contribute to students' desire to learn mathematics. When students see themselves as capable of doing well in mathematics, they tend to value mathematics more than students who do not see themselves as capable of doing well (Ames, 1992; Dweck, 1986; Meece, Blumenfeld, & Hoyle, 1988; Middleton, 1995; Middleton & Spanias, 1999; Schiefele & Csikszentmihalyi, 1995).

In this study, I used an interpretivist lens to define motivation in ways the participants spoke of. Participants' personal capital includes both their intrinsic and extrinsic motivation. Their intrinsic motivation was evidenced by their desire to maintain good grades, pass tests, and be a member of the top group. Also, for the participants, it was essential that they complete assignments and do their best. They were eager to seek assistance from their peers or teacher (on rare instances) to reach their academic goals. The participants' meanings are not necessarily a priori definitions as described in the motivation literature. Nonetheless, it was significant for this study to adopt the participants' views of how they are intrinsically and extrinsically motivated to participate in mathematics because with regard to most traditional motivation theories, the motivations of African American and Latino/a students have not been studied. Scholars who have studied the motivational patterns of African American and Latino/a students suggest a pattern of neglect reflected from the decreased amount of published research on the motivation of ethnic minorities (Graham, 1994; Taylor & Graham, 2007). Graham's (1994) motivation research on African Americans cites that 103 of 133 studies are race-comparative. Rather than describing what actually motivates African American students academically, the studies focus on comparing African Americans to Whites via the achievement gap and showing that African Americans are motivationally inferior to Whites. As well, some researchers claim that the achievement gap persists because of cultural deficit theories that imply that students of color are products of pathological lifestyles which counteract any form of positive motivation for academic success (Ladson-Billings, 2006). Taylor & Graham (2007) have studied the motivation patterns of African-American and Latino/a students. In their view, these ethnic minority students have to deal with negative cultural stereotypes often reinforced by peers, teachers and school administrators. As such, these ethnic minority students' motivations to do well in school are often undermined. Thus, the participants' discussions of their motivations to participate in mathematics offer invaluable information that is generally not reflected in the motivation literature.

Intrinsic Motivation

Participants' intrinsic motivation stemmed from their innate desire to excel in mathematics and their high degree of self-regulation. They worked hard to be high-achieving mathematics students. It was a necessity for them to succeed in mathematics.

Ashley explained that, "this year, being in Algebra 1 was very challenging, but I learned to be more responsible. I liked being in the top group and I wanted to get good grades" (Ashley, Journal Log Entry, May 28, 2007). Santana felt that "I just wanted to pass so I worked very hard and I passed. I'm just glad all the tests are over. I learned that hard work pays off. I learned that I was a hard worker in math class and I could do better than I thought" (Santana, Journal Log Entry, Week of May 28, 2007). For Xavier, failing just could not occur. He said," In my family, failure is not option. I must pass my classes" (Xavier, Focus Group Interview, June 4, 2007). Others were self motivated because of a desire to think independently. Chad believed, "like, it's independent work. When you have to do it by yourself, you have to think and like, you can get motivated by doing stuff on your own. That's what I think" (Chad, Individual Interview, April 23, 2007). Carlos also expressed his self motivation this way, "what motivates me to do math is sometimes when you are doing something, you need math to figure it out. Also, you want to get the right answer and not make mistakes" (Carlos, Focus Group Interview, May 16, 2007). Jayceona added,

> Well, I learned how to not only enjoy working in groups, but also how to develop my own independent thinking pattern. I mean, working in groups is very helpful but in the end, I have to come up with my own ways of understanding the math. (Jayceona, Journal Log Entry, Week of April 23, 2007)

For Nicee and Nicole, mathematics has always been easy so naturally they are self motivated to do mathematics. Nicole claimed that, "well, math is my favorite subject and has always been easy and it was also easy this year" (Nicole, Journal Log Entry, Week of May 21, 2007). Nicee reiterated that, "I feel good about math and because I enjoy it, I am motivated to keep doing it" (Nicee, Focus Group Interview, June 4, 2007).

For Christian, mathematics did not come as easily, but she had the ability to buckle down and complete the assignments when necessary. She remarked:

> This year, I learned that I can learn anything if I try. For example, I took the Algebra I test the other day and I had missed a few days so my teacher handed me a math book and told me to look up matrices. So, I looked over them in the book and tried two or three problems and I got all the matrices problems right on the test. When I try to learn, all I have to do is look at it and I get it. I'm a quick learner when I want to learn something. (Christian, Journal Log Entry, Week of May 28, 2007)

Carlos also spoke of his being self-regulated to work hard in mathematics. In his words,

> Well, I still am not a very good math student, but I do work hard. I learned if you can't get it from the teacher, you got to work it out the best way you can. Use a calculator, the book, or a friend in class who you can get along with to help you.
>
> (Carlos, Journal Log Entry, Week of April 30, 2007)

<u>Extrinsic Motivation</u>

While some participants had an innate desire for mathematics, others had to have external motivations for doing mathematics. These included prior experiences, in and out of school; family expectations; cultural norms; and future career goals. Many of the participants could recall prior experiences with past teachers and in extracurricular programs that presently serve as motivation for them to participate in mathematics. Christian recalls that, "Last year, I had a teacher and we loved her. We didn't like math, but we loved her and she helped us learn it" (Christian, Individual Interview, May 7, 2007). Also, Christian said the following about her previous mathematics teacher:

> I had the same teacher for two years in the sixth and seventh grade. I'll talk about her and then, I'll talk about my teacher this year. Teacher before, she brought her own life into the class. And she didn't put on a show for us. That's what I like the most. She was real about you've got to do your work or else.
>
> (Christian, Focus Group Interview, May 16, 2007)

Many participants were extrinsically motivated by the fun activities in which they were engaged in previous mathematics classes. Nicee expressed that:

> I would do like my old teacher, my seventh grade teacher. She, like, made songs out of math. You know lots of kids like songs. So like, maybe if you put the math equations in a song or something or like a beat, they'll catch on because that really worked with us last year.
>
> (Nicee, Focus Group Interview, May 16, 2007)

Further, Chad added:

> We did more projects. Like, the projects we did were fun. Like, we did about, uh, like we had to open up our own business. And you had to add up everything. I had a big house and all that. It was just fun to me.
>
> (Chad, Individual Interview, April 23, 2007)

Santana mentioned that:

> Like, we had played a game called Math Jeopardy from all that we had learned and we had, like, we had different things that you could pick. Then if we get the question right, we would get a certain amount of points. Um...because that's how you can get kids involved by playing games. If you just teach them, it will start getting boring.
>
> (Santana, Focus Group Interview, June 4, 2007)

Carlos commented that, "Ms. Turner was a fun teacher. We got to play games with her. She made everything fun" (Carlos, Individual Interview, April 23, 2007). For Chad, there was a need for fun and laughter in the mathematics classroom. He stated that, "socially, in math class, we laughed and joked sometimes. The laughter helped because it let us know that we don't always have to be serious but sometimes, we can have fun while doing math" (Chad, Journal Log Entry, Week of May 21, 2007).

Christian expressed her need for fun and excitement when learning mathematics. She mentioned the following:

> It's like you might not like math, but once it gets to ticking, once you get excited about it, it gets in your head and you can't stop thinking about it. To the point where it gets stuck. Because, um, like my kilo…hecto…deka…measurement…If I'm sitting in class and be like, which end is this in? I would be like kilo, hecto, deka,…it's in deka and they would be like that's it and like songs I learned from fifth grade about mean, median, and mode…we made up a rap or something and it's like median, median…he's the man…the man in the middle…the man in the middle. And that's how I always knew that median is the center of the numbers. And it's just stuff like that, which stayed in my head. The math teacher made that rap and I remember every word of the rap. It's like something that gets stuck in your head. It's just, I don't know, it's just something that gets there and you never get it out.
>
> (Christian, Focus Group Interview, May 16, 2007)

The participants also recalled mathematical experiences in after school and summer programs.

Nicole recalled,

> I went in the summer to Winston-Salem State University when I was nine for two years, and I went to SEMAA when I was eight and it was fun. In SEMAA, I had math and science; we had different classes. I already knew a lot. We went to the park and looked at animals and researched what kind of food they eat. We did...in the math part, he taught us how to do business proposals.
>
> (Nicole, Individual Interview, May 7, 2007)

Jayceona also recounted:

> We had this program called "SYS – Successful Young Scholars". It was an after school program. We did like some of the stuff we do now but not as advanced. We did multiplication of two-digit and some three-digit numbers. We used to do math patterns too and the math wasn't boring at all. It was really fun. It was a certain strategy that they taught me. Like, if you see a certain type of problem, and then just remember a little saying and honestly, I don't remember the saying. But, I do remember the problem solving strategies I learned in fifth grade and I use them in eighth grade now.
>
> (Jayceona, Individual Interview, May 15, 2007)

Participants were extrinsically motivated by their family expectations and cultural norms. Xavier clearly stated that there were specific educational expectations in his native country.

He explained:

> In Peru, we don't have elective classes. There is no gym or band…We just go to regular core classes. It's real hard. It is much harder than here in America because in Peru, they do three lessons a day instead of one. They make you really learn in class instead of just chilling out. My country is not a free country where you can do whatever you want to. There are rules to follow and it is much more disciplined. The students respect the teachers and truly want to get their education. My experience in Peru helps me develop discipline for school here. Like in the fifth grade, I was the only one who set up straight in my chair and did my work without being told to. There were so students in my class who were just messing around and not doing their work. That was never allowed in Peru. The discipline I learned in Peru helps me stay focused in my math class.
>
> (Xavier, Individual Interview, May 15, 2007)

Jayceona is motivated by her father, She clarified:

> My motivating factor is my father who I know would not approve of my negative attitude so I try to work hard in spite of how my day has been. I know math is needed in my future so I do my best. My dad also taught me the importance of being independent so if I do well in math and get a good job, I can take care of myself.
>
> (Jayceona, Focus Group Interview, June 4, 2007)

Santana is also motivated by his father. he stated:

> What motivates me to do math is my daddy because he used to help me with all my work and I would get all A's. He gets mad whenever I get a bad report card, but he gives me words of encouragement and tells me I can do better. He tells me to listen to the teacher and to ask questions if I need to.
>
> (Santana, Focus Group Interview, June 4, 2007)

Christian has two younger brothers whom she loves dearly. She aspires to help them become successful. In her words,

> Once I'm in the math class, the only thing that motivates me is the fact that I have to teach two young people [my little brothers] how to do math when they get older. I want to be able to tell them how to do math in five years and if I can't, here's a problem.
>
> (Christian, Focus Group Interview, June 4, 2007)

Finally, participants expressed that they were motivated to participate in mathematics because of their future career goals. Chad stated:

> Yes, because if you don't know math you can't succeed in life. Because, you got a check you work for somebody and don't know how much they paying you. They might be...they could be playing with your money and you'll never know, especially when you make big dollars.
>
> (Chad, Individual Interview, April 23, 2007)

Nicole further stated that:

> What motivates me to do math is I know in the world, there is so much math. If you don't know math, you won't make it in life because so many occupations rely on math. Yeah, like, I want to be a pediatrician and I also want to open my own business. A pediatrician...you have to give babies...you could give a baby too much medicine. It could affect their life and stuff like that. I want also to be a cosmetologist and you have to use chemicals. You have to handle chemicals. Because I want be a pediatrician, I know I need to know my math plus I like spending money so I have got to make a lot of money. So, mostly what motivates me is the money and my future. (Nicole, Focus Group Interview, June 4, 2007)

Both Jayceona and Xavier are interested in playing professional sports so therein lay their motivations. Xavier says that, "my motivation is that I want to play soccer so I do well so I can remain on the team" (Xavier, Focus Group Interview, June 4, 2007).

Jayceona expressed that,

> You know if you don't do well, you're not going to make it in life. And the jobs I want to have 'cause I want to be a lawyer or a women's professional basketball player and like another student said I have to know my formations in basketball in order to score points and win the game. So, if I can't do math, I'm not guaranteed to make it to the WNBA. So, me wanting to play basketball in the future is what motivates me also to do math.
>
> (Jayceona, Focus Group Interview, May 16, 2007)

## Summary

This chapter summarized the two main themes of the study: (a) sociocultural capital, and (b) personal capital. These themes as evidenced by the connections to mathematics and motivation of the nine African-American and Latino/a eighth grade participants show that they possess human resource capital which connects their out-of-school experiences to their mathematics learning. Further, their individual engagement as well as interactions within the mathematics community of practice leads to the development and their awareness of their specific mathematics identities.

# CHAPTER V

# CONCLUSIONS

## Introduction

This study focused on the human resource capital – sociocultural and personal of nine eighth grade African-American and Latino/a students. Both types of capital are interrelated as participants engage within a mathematics community of learners, make relevant connections to mathematics and are motivated to learn and do well in mathematics. In the last chapter of this dissertation, I provide answers to the five research questions based on the study findings as they relate to the research literature. As well, implications for mathematics education and further research are included.

## Research Questions Addressed

Research Question 1: What is the human resource capital (human capital, sociocultural capital, and personal capital) of ethnic minority middle school students as it relates to mathematics?

These ethnic minority students were able to accurately describe their human resource capital in terms of both sociocultural capital and personal capital. Initially, I sought to investigate all three forms of participants' human resource capital as defined by Gordon (1999): human capital, sociocultural capital, and personal capital.
However, students' recollections of their experiences and motivations regarding mathematics did not include any reference to human capital. As well, the analysis of data

did not lead to any evidences of a human capital theme among the participants. Based on Critical Race Theory, the human capital of marginalized populations (African Americans and Latino/as) is not explicitly valued by schools and society. One of the tenets of Critical Race Theory is that society values property rights while devaluing human rights, especially for African Americans. In schools as well as in society in general, ethnic minority students' human values are not emphasized (Ladson-Billings & Tate, 1995). Because the participants in this study may not have been given the chance to focus on their individual human values, they did not discuss those values as a component of their human resource capital.

Therefore, for this study, participants' human resource capital stemmed solely from their sociocultural capital and personal capital. The participants' sociocultural capital stemmed from their interactions with peers within the mathematics community of learners, and also from social networks formed with family members and friends. A few participants mentioned using mathematics while helping family members complete chores, paint, lay carpet, wash clothes, balance checkbooks, and shop. There were many other instances where these participants described their sociocultural capital. Most of the participants were involved in extracurricular activities including athletics, band, chorus, dance, and physical education where they made relevant connections between these activities and the mathematics they learned in mathematics this year and in previous years. Also, these eighth graders were well aware of the many career paths related to mathematics and the importance of mathematics in anything they choose as a life goal.

In terms of personal capital, participants described being both intrinsically and extrinsically motivated to engage in mathematics. Because the nine participants were in the top math class, Algebra I, on their team, many were self-motivated to stay on track to remain a part of the top group. Still others' intrinsic motivation was derived from a desire to pass tests and earn good grades. The family expectations of the participants played a major role in them being extrinsically motivated to do mathematics. For one student, the cultural norms of his native country dictated for him the level of commitment to the mathematical challenge within the mathematics community of practice. He was accustomed to strict guidelines and high expectations so working hard in mathematics was the accepted way. Most of the eighth graders had specific career goals and realized the need for mathematics to have successful futures. Participants described their prior mathematics learning from previous teachers as an extrinsic motivating factor. Vygotsky (1978) emphasizes the role of the teacher in introducing students to significant sociocultural practices. Many could recall playing games, learning math raps, and simply having fun with their former mathematics teachers. The prior knowledge gained from these teachers and from summer and after school programs is a form of personal capital described by the participants.

Research Question 2: How do ethnic minority middle school students engage in a mathematics community of practice?

In this study, participants engaged in the community of practice by working individually, in groups, playing mathematics games, by communicating their mathematical thoughts both verbally among each other and in written form in journals and on mathematics assessments. Most of the participants cited that they enjoyed collaborative, hands-on activities and cooperative learning. Cooperative learning is a group learning process based on the understanding that people learn better when they learn together. Cooperative learning provides an alternative to the traditional classroom in which the teacher is up front teaching the class as a whole or supervising individualized seat work. It also provides an alternative to competition among students for attention, approval and achievement. In the cooperative learning model, the focus is shifted from teaching to learning, from the individual relationship between teacher and student to the relationship of the student to the class as a community of learners. Research indicates that students perform better on mathematical tasks when activities are more exploratory integrated with problem solving (Lubienski, 2000; Schoenfeld, 1992) . It is more important for students to understand why they arrived at a solution rather than merely getting the correct answer (Sfard, 2001; Van Oers, 2001). The nine participants all agreed that they disliked the lecture style of teaching with the same old routine and an enormous amount of notes to be copied and problems to be worked from the textbook or worksheets. They cited that they preferred more challenging mathematical activities and more communication with the teacher. Zack and Graves (2001) feel that students do need effective teacher-student interactions, but peer social networks are important as well. As such, the participants cited that they enjoyed communicating among themselves within the mathematics community of practice as a means of better understanding their mathematics. The teacher's lack of purposeful planning led the participants to construct their own community of practice. Resistance theorists propose that students' backgrounds influence everyday forms of student resistance in schools. Social network relations enable students to consistently undermine and redirect classroom activities. Resistance behavior in classrooms stems from poor classroom management and instruction that alienates students (McFarland, 2002). In alignment with resistance theory, the participants challenged the traditional classroom norms of the teacher feeding information to them via lecturing and adopted their own ways of learning via their interpersonal relationships with each other. One of the National Council of Teachers of Mathematics standards addresses communication in mathematics classrooms (NCTM, 2000). This standard proposes that students make sense of mathematics by explaining their invented strategies for solving problems and by listening to and reflecting on the strategies of others (Forman & Ansell, 2001; NCTM, 2000).

Research Question 3: What is the impact of their human resource capital (human capital, sociocultural capital, and personal capital) on their engagement in a mathematics community of practice?

Research Question 4: How do ethnic minority middle school students describe their mathematics identities?

The nine participants in the study thrived on social relationships both in and outside of their mathematics classroom. From a sociocultural perspective, almost all of the participants enjoyed collaboration within the mathematics classroom. They believed that group work was central to creating a sense of community in the math class. This sense of community within a learning environment is what Wenger (1998) calls a 'community of practice'. In Wenger's (1998) view, a community of practice is comprised of a group working in a concerted effort to achieve a common goal. In this regard, the participants were all working together and often in collaborative groups and they all seemed to have one vision, one goal: to help each other become successful. Most of the participants expressed their enjoyment of group work as a way to communicate their ideas to one another and help partners who did not understand and/or provide assistance to group members who lacked mathematical competence on the content being addressed by the teacher. The social learning component was pivotal to the participants' engagement within the mathematics community of practice. For many of them, communicating mathematically about mathematics lessons, discussing their own personal ways of arriving at mathematical solutions and actually being involved in doing mathematics helped them to foster a better understanding of the mathematics content. As well, working in groups encouraged them to participate more fully because it allowed them to tap into their social side, what Vygotsky describes as the "social situation of development." As well, Yackel and Cobb (1996) believe that interactions and social processes are integral components of mathematics learning within classroom activities. Engagement, both socially and culturally, in the culture of the mathematics classroom leads to mathematics learning, both directly and indirectly (Yackel & Cobb, 1996).

The eighth grade ethnic minority students in this study described their mathematics identities based on being good at mathematics and as a high achiever in mathematics, mostly based on grades and standardized test scores. As well, many of the participants described themselves as being responsible, committed, and hard working. These students felt that they were responsible in that they were intrinsically motivated to do well in mathematics. Also, many of the participants formed their mathematics identities based on the perception of their peers viewing them as mathematically competent. By middle grades, students often begin to perceive mathematics to be a special domain in which smart students succeed and other students merely get by or fail. When students see themselves as capable of doing well in mathematics, they tend to value mathematics more than students who do not see themselves as capable of doing well. Student who view mathematics as a process, guided by their own search for knowledge, tend to value the construction of conceptual mathematical understanding, and as a result are intrinsically motivated because the knowledge they develop is their own (Cobb, Boufi, McClain, & Whitnack, 1997; Middleton, 1995; Middleton & Spanias, 1999). The participants in this study used their individual and collective human resource capital as a resource for developing agency to resist the traditional classroom structure. As such ,their collective agency served as a form of self-empowerment. As well, some form of resistance was drawn from their prior experiences with hands-on, engaging teachers. The participants drew on their sociocultural capital to interact interpersonally. The use of their personal capital as a resource highlights the power of their individual funds of knowledge. The fact that the participants were able to articulate how their social networks with their family members enhances their learning of mathematics within the community of practice shows that this study directly counters the deficit theory of family involvement for ethnic minority students. Proponents of the deficit theory of family involvement believe that for ethnic minority students, the home environment and perceived lack of value that their parents place on education leads to students' deficiencies in academic achievement (DeCastro-Ambrosetti & Cho, 2005). Conversely, the participants in this study felt that their interactions with their parents had a positive influence on their education and mathematics learning.

<u>Research Question 5: What is the impact of their engagement in a mathematics community of practice on their mathematics identities</u>?

In this study, it was important for the participants to develop a sense of themselves as doers of mathematics. Their mathematics identities, who they saw themselves to be mathematically, and who their peers saw them to be mathematically was linked to their engagement in the mathematics community of practice. Even when the teacher could not adequately get the point across to the students, they relied on each other. The participants often sought assistance from those whom they perceived to have a strong mathematics identity. Also, if a student felt that they possessed a strong mathematics identity, they were eager to help. The fact that the students were engaged in collaborative tasks within the mathematics community of practice allowed them to develop their mathematics identities. According to Cobb (2002), students' engagement in mathematics as well as their diverse ways of contributing within the mathematics community of practice leads students to feel more comfortable with the mathematics that is taught. This integration of skills leads to the creation and/or further cultivation of individual mathematics identities (Martin, 2000; Sfard, 1991). Many students dislike mathematics and view it merely as a tool for reaching mathematical solutions. For these participants, their mathematics identities went far beyond merely viewing mathematics as a tool for problem solving. Rather, the participants were able to internalize their mathematics knowledge, skills, and dispositions. This internalization allowed them to see themselves as being mathematically competent with the ability to assist others in the development of their mathematics competence.

## Implications for Mathematics Education

This study indicates the need for students to be able to work collaboratively, communicate their mathematical ideas, develop social networks and a sense of community within the mathematics classroom, as well as view mathematics as relevant to their lives. The findings of this study have the potential to transform mathematics learning with the incorporation of mathematical discourse, culturally relevant instruction, and reliance on students' mathematics identities to develop meaningful classroom activities. Use of these strategies will empower learners to use their human resource capital as a resource to create a "pedagogy of hope and engagement." Such a pedagogy will stem from the connections between students' personal capital, sociocultural capital, and classroom engagement. The intertwining of students' in-school and out-of-school experiences as well as social relationships with students, their teachers, peers, and parents will encourage the existence of viable home, school, and community collaborations. The following implications are noted:

A. Teachers need to implement inquiry-based learning into mathematics classrooms. In these settings, the teacher's role is to facilitate mathematical discussions. Yackel and Cobb (1996) describe how mathematical norms and sociocultural norms can merge into socio-mathematical norms in mathematics discussions. Furthermore, group discussions in mathematics allow teachers to capitalize on the learning opportunities that arise for them as they listen to their students' explanations (Lampert, 1990; Nathan & Knuth, 2003; Sherin, 2002). Davis (1997) describes three modes of listening: (a) evaluative listening, in which listening is the sole responsibility of the listener; (b) interpretive listening, which involves active interpretation and deliberate listening; and (c) hermeneutic listening, the most effective mode of listening, which involves the hearer and the heard in a shared form of engagement. As well, Davis (1997) discusses the notion of listening as a useful way to draw out some key elements of students' shared meanings and conceptions of mathematics learning.

B. In order to accommodate the social and cultural needs of African American and Latino/a students, instruction needs to be culturally mediated. Teachers should incorporate culturally relevant pedagogical practices into mathematics instruction. Cultural connectedness within the mathematics classroom involves the incorporation of multicultural activities that foster an awareness of cultural history, values, and contributions of diverse groups (Ensign, 2003). As a central component of learning, culture shapes the process of thinking and communicating among students in mathematics classes (Draper, 2002). Teachers of mathematics must acknowledge students' diverse mathematical experiences outside of the classroom by weaving them into the academic content (Ensign, 2003). When teachers connect what they do in the classroom to students' cultural backgrounds, students begin to understand themselves and others who may or may not be culturally similar. Additionally, these cultural connections structure social interactions and allow students as well as teachers to recognize culture as a strength within the school setting (Draper, 2002).

C. Since mathematics is about forming identities, it is important for teachers to identify the mathematics identities that students develop and how these identities support or hinder meaningful mathematics learning. The ways in which mathematics teachers structure their classroom tasks can greatly influence students' views of mathematics. Teachers must reflect on their instructional goals and how their mathematical approaches relate to students' needs (Knuth & Peressini, 2001; Lerman, 2001; Middleton, 1995).

## Implications for Further Research

Based on the finding of this research, implications for future research include the following:

A. Follow-up qualitative studies on a broader scale to include a larger pool of participants, more middle schools, and a longer data collection time period.

B. More studies on the human resource capital that students bring to school and its impact on mathematics learning.

C. More studies on development of mathematics identities among middle school students.

D. More studies on ethnic minority groups regarding how they learn and do mathematics.

E. Multivariate (race/ethnicity, gender, class) mixed methods studies examining the relationship between human resource capital and mathematics competence.

F. Longitudinal studies to follow the nine participants through their high school years.

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APPENDIX A

PARTICIPANT ASSENT FORMS

**Student Assent Form**

**Project Title**

"The impact of human resource capital on ethnic minority middle school students' engagement in a mathematics community of practice and their mathematics identities"

**Project Director**

Ms. Tracey Keck, M.Ed

Doctoral student at University of North Carolina at Greensboro

Participant's Name ______________________________________________________

I am a doctoral student at the University of North Carolina at Greensboro and am doing a study to find out students' opinions about how they learn math. I am doing this study because I don't know very much about how students your age feel about learning math. I explained the benefits and risks of your participation during my oral presentation. There are several benefits, but no risks to you for participating in this study.

If you agree to be in the study, I will ask you a series of questions about how you learn math. These questions are about what you think and there are no right or wrong answers because this is not a test. The interview with you will only last 30-45 minutes and will be audio taped. Also, I will observe you in your math class and ask you to keep a small journal. In the study, your real name will not be used. I am the only one who will see my research notes. Your participation, while greatly appreciated, will be totally voluntary. If you choose to be in the study, please sign below. Remember, being in the study is up to you. There will be no penalty if you don't sign this form or if you change your mind later. Do you have any other questions?

_____________________________________________________ Date ______________

Signature of Participant

_____________________________________________________ Date ______________

Witness

_____________________________________________________ Date ______________

Signature of person obtaining assent on behalf of UNCG

**Forma del asentimiento del estudiante**

**Título de proyecto**

"El impacto del capital del recurso humano en los estudiantes étnicos' contrato de la escuela media de la minoría en una comunidad de las matemáticas de la práctica y de sus identidades de las matemáticas"

**Director del proyecto**

Ms Tracey Keck, M.Ed

Estudiante doctoral en la universidad de Carolina del Norte en Greensboro

Nombre del participante _______________________________________________

Soy un estudiante doctoral en la universidad de Carolina del Norte en Greensboro y que hace un estudio para descubrir opiniones a los estudiantes las' sobre cómo aprenden matemáticas. Estoy haciendo este estudio porque no sé mucho sobre cómo los estudiantes tu sensación de la edad sobre matemáticas que aprende. Expliqué las ventajas y los riesgos de su participación durante mi presentación oral. Hay varias ventajas, pero ningunos riesgos a usted para participar en este estudio.

Si acuerdas estar en el estudio, te haré una serie de preguntas acerca de cómo aprendes matemáticas. La entrevista con ti durará solamente cerca de treinta minutos y será grabada en audio. También, te observaré en tu clase de la matemáticas y pediré que guardes un diario pequeño. En el estudio, tu nombre verdadero no será utilizado. Te no fuerzan ser una parte de este estudio. Tu participación, mientras que está apreciada grandemente, será totalmente voluntaria. Estas preguntas están sobre lo que piensas y no hay respuestas derechas o incorrectas porque esto no es una prueba. Si eliges estar en el estudio, firmar por favor abajo. Recordar, estando en el estudio está hasta ti. No habrá pena si no firmas esta forma o si cambias tu mente más adelante. ¿Usted tiene otras preguntas?

_______________________________________________ Date ____________

Firma del participante

_______________________________________________ Date ____________

Testigo

_______________________________________________ Date ____________

Firma de la persona que obtiene asentimiento a nombre de UNCG

# APPENDIX B

## PARENTAL CONSENT FORMS

**Informed Consent Form to Permit your Son/Daughter to Participate in a Research Study**
**SHORT FORM WITH ORAL PRESENTATION**

**Project Title**
"The impact of human resource capital on ethnic minority middle school students' engagement in a mathematics community of practice and their mathematics identities"

**Project Director**
Ms. Tracey Keck, M.Ed
Doctoral student at University of North Carolina at Greensboro

Participant's Name ______________________________________________________

Ms. Tracey Keck has explained in the preceding oral presentation the procedures involved in this research project including the purpose and what will be required of your child. Any benefits and risks were also described. Ms. Keck has answered all of your current questions regarding your child's participation in this project. There will be no risk or adverse consequences affecting your child and no one is forced to be a part of this study. Participation, while greatly appreciated, is totally voluntary. Your child's privacy will be protected because s/he will not be identified by name as a participant in this project. The research data will be kept in a locked file cabinet and destroyed after five years.

The University of North Carolina Institutional Review Board, which ensures that research follows federal guidelines has approved the research as well as this informed consent form. Questions regarding your child's rights as a participant in this project can be answered by calling Mr. Eric Allen at (336) 256-1482. Specific questions regarding the research can be directed to Ms. Tracey Keck at (336)750-2487 or her faculty advisor, Dr. Ceola Ross Baber at (336) 334-4667.

By signing this consent form, you are agreeing to allow your child to participate in the research study described by Ms. Keck. You further agree that you understand the procedures involved in this research study.

_____________________________________________ Date ______________
Signature of Parent/Guardian

_____________________________________________ Date ______________
Witness

_____________________________________________ Date ______________
Signature of person obtaining consent on behalf of UNCG

Forma informada del consentimiento para permitir que tu hijo/hija
participe en un estudio de la investigación

**FORMA CORTA CON LA PRESENTACIÓN ORAL**

**Título de proyecto**

"El impacto del capital del recurso humano en los estudiantes étnicos' contrato de la escuela media de la minoría en una comunidad de las matemáticas de la práctica y de sus identidades de las matemáticas"

**Director del proyecto**

Ms Tracey Keck, M.Ed
Estudiante doctoral en la universidad de Carolina del Norte en Greensboro

Nombre del participante ____________________________________________________

Ms Tracey Keck ha explicado en la presentación oral precedente que los procedimientos implicaron en este proyecto de investigación incluyendo el propósito y qué será requerida de tu niño. Cualesquiera ventajas y riesgo también fueron descritos. Ms Keck ha contestado a todas tus preguntas actuales con respecto a la participación de tu niño en este proyecto. No habrá riesgo o las consecuencias adversas que afectan a tu niño y a nadie se fuerzan para ser una parte de este estudio. La participación, mientras que está apreciada grandemente, es totalmente voluntaria. La aislamiento de tu niño será protegida porque s/he no será identificado por nombre como participante en este proyecto. Los datos de la investigación serán mantenidos un gabinete bloqueado del archivo y destruidos después de cinco años.

La universidad del comité examinador institucional de Carolina del Norte, que se asegura de que la investigación siga pautas federales ha aprobado la investigación así como esta forma informada del consentimiento. Preguntas con respecto a las derechas de tu niño como participante en este proyecto pueden ser contestadas llamando a Sr. Eric Allen en (336) 256-1482. Preguntas específicas con respecto a la investigación se pueden dirigir a ms Tracey Keck en (336) 750-2487 o su consejero de la facultad, El Dr. Ceola Ross Baber en (336) 334-4667.

Firmando esta forma del consentimiento, estás acordando permitir que tu niño participe en el estudio de la investigación descrito por ms Keck. Convienes más lejos que entiendes los procedimientos implicados en este estudio de la investigación.

_______________________________________________ Fecha ______________
Firma del padre/del guarda

_______________________________________________ Fecha ______________
Testigo

_______________________________________________ Fecha ______________
Firma de la persona que obtiene consentimiento a nombre de UNCG

# APPENDIX C

# POWERPOINT PRESENTATIONS

## Hearing from Middle School Students…

What is your view of how you learn mathematics?

Ms. Tracey Keck, a UNCG doctoral student wants to know.

## Purpose of Study

To find out how eighth grade students react to learning math in the classroom.

BENEFITS OF STUDY:

The study will give students the opportunity to voice their individual viewpoints on their participation in their math classes.

Teachers should discover better ways to help students learn math.

**<u>There are no risks or consequences of participating in the study</u>**

## Participation

- Participation, while greatly appreciated, is totally voluntary.
- No one is forced to be a part of the study
- There is always the opportunity to withdraw without penalty.

## In the study, the researcher will…

- Conduct audio taped individual interviews (30-45 minutes) of participants individually and in groups (45 minutes – 1 hour).
- Gather information from participants on their views about learning math by having them keep journal logs.
- Observe the math classroom environment of participants.
  - There will be 3 individual interviews per participant, 2 focus group interviews, and 3 observations during this study.

## Confidentiality

- The information gained will be used for research and responses will be kept confidential.
- Neither participants' real names nor the school name will be used in any research reports.
- Only the principal researcher will have access to research records.
- All research study materials will be locked in a file cabinet in the researcher's office and will be destroyed after five years. My research notes will be shredded; audiotapes will be erased and crushed.

## Choosing to participate

- Parents/guardians must sign informed consent forms.
- Participants must sign assent forms.
- Teachers must sign informed consent forms.

The University of North Carolina Institutional Review Board, which ensures that research follows federal guidelines has approved the research as well as informed consent forms and assent forms.

## Questions???

- Questions regarding your participants' rights in this project can be answered by calling Mr. Eric Allen at (336) 256-1482.
- Specific questions regarding the research can be directed to Ms. Tracey Keck at (336)750-2487 or her faculty advisor, Dr. Ceola Ross Baber at (336) 334-4667.

## THANKS!

ARE THERE ANY QUESTIONS?

## Audiencia de estudiantes de la escuela media…

¿Cuál es tu opinión de cómo aprendes matemáticas?

**Ms Tracey Keck, un estudiante doctoral de UNCG desea saber.**

## Propósito del estudio

Para descubrir cómo octavos estudiantes del grado reaccionar a la matemáticas que aprende en la sala de clase.

VENTAJAS DEL ESTUDIO: El estudio dará a estudiantes la oportunidad de expresar sus puntos de vista individuales en su participación en sus clases de la matemáticas. Los profesores deben descubrir maneras mejores de ayudar a estudiantes a aprender matemáticas.

**No hay riesgos o consecuencias de participar en el estudio**

## Participación

- La participación, mientras que está apreciada grandemente, es totalmente voluntaria.
- Nadie se fuerza para ser una parte del estudio.
- Hay siempre la oportunidad de retirarse sin pena.

## En el estudio, el investigador…

- Entrevistas grabadas en audio del individuo de la conducta (30-45 minutos) de participantes individualmente y en los grupos (45 minutos - 1 hora).
- Información del frunce de participantes en sus opiniones sobre matemáticas que aprende haciendo que guarden registros del diario.
- Observar el ambiente de la sala de clase de la matemáticas de participantes.
  - Habrá 3 entrevistas individuales por participante, 2 entrevistas del grupo principal, y 3 observaciones durante esto estudian.

## Secreto

- La información ganada será utilizada para la investigación y las respuestas serán mantenidas confidenciales.
- Ni los nombres verdaderos de los participantes' ni el nombre de la escuela serán utilizados en cualquier informe de la investigación.
- Solamente el investigador principal tendrá acceso a los expedientes de la investigación.
- Todos los materiales del estudio de la investigación serán trabados en un gabinete del archivo en la oficina del investigador y destruidos después de cinco años. Mis notas de la investigación serán destrozadas; las cintas magnéticas para audio serán borradas y machacadas.

## El elegir participar

- Los padres/los guardas deben firmar formas informadas del consentimiento.
- Los participantes deben firmar formas del asentimiento.
- Los profesores deben firmar formas informadas del consentimiento.
  - La universidad del comité examinador institucional de Carolina del Norte, que asegura esa investigación sigue pautas federales ha aprobado la investigación así como formas informadas del consentimiento y formas del asentimiento.

## ¿Preguntas???

- Preguntas con respecto derechas de tus participantes las' en este proyecto pueden ser contestadas llamando a Sr. Eric Allen en (336) 256-1482.
- Preguntas específicas con respecto a la investigación se pueden dirigir a ms Tracey Keck en (336) 750-2487 o sus consejeros de la facultad, el Dr. Ceola Ross Baber en (336) 334-4667.

## ¡AGRADECE!

¿HAY PREGUNTAS?

APPENDIX D

OBSERVATION PROTOCOL

Date: ______________________________ Name of Observer: ______________________
Name of Teacher: ___________________ Observation Location: ____________________

| | |
|---|---|
| 1. Describe the mathematics community of practice. | |
| 2. Describe how the teacher is helping the participants to engage in the mathematics community of practice. | |
| 3. Describe the specific classroom activities in which the participants are engaged. | |
| 4. Describe the participants' observed feelings/reactions [math identity] to their engagement. | |
| Describe the student-to-student interactions [sense of community]. | |
| 6. Describe the teacher-to-student interactions. | |
| 7. Describe the level of listening and attentiveness of the participants. | |

APPENDIX E

INDIVIDUAL AND FOCUS GROUP INTERVIEW PROTOCOL

**Interview Protocol**

Time of Interview:
Date:
Place:
Interviewer: Tracey Keck, M.Ed, UNC Greensboro
Interviewee:
Position of Interviewee:

<u>Project Description</u>:

(a) The purpose of the study is to understand the impact of human resource capital on ethnic minority students' engagement in a mathematics community of practice and their mathematics identities.

(b) Eighth grade ethnic minority students will be interviewed individually. The interviews will be audio taped and notes will be taken by the interviewer.

(c) To protect confidentially, participants' real names will not be used. As well, transcripts of all interviews will be securely locked in a file cabinet in the interviewers' office. Audio tapes will be destroyed and transcripts will be shredded after five years.

(d) The interviews should each last approximately 30-45 minutes.

<u>Individual Interview Questions</u>:

(1) Describe a typical day in your math class.

(2) What do you like about your math class?

(3) What do you dislike about your math class?

(4) How do you feel about math? Why?

(5) Do you think math is important? Why?

(6) How do you view yourself as a math student?

(7) Do you use math outside of school? In what ways?

(8) Do you do math better individually or in a group? Why?

(9) What does your teacher do to help you do well in math? Or challenge you in math?

(10) How do you feel when your teacher calls on you in math class?

(11) How do you feel when you get the right answer or do well on a test in math?

(12) If you were a math teacher, how would you get your students involved in the math class? Why do you think your ideas would work?

(13) Tell me everything you can remember about elementary school?
(a) In school
(b) Out of school
(c) With family and friends
(d) Is math involved in any of the activities in which you were involved in elementary school? If so, in what ways?
(e) Did these activities relate to anything you have learned in mathematics this year? If so, how?

(14) Tell me everything you can remember about your sixth and seventh grade years?
(a) In school
(b) Out of school
(c) With family and friends
(d) Is math involved in any of the activities in which you were involved in sixth and seventh grades? If so, in what ways?
(e) Did these activities relate to anything you have learned in mathematics this year? If so, how?

(15) Explain the mathematics involved in the math scenario that you all created.

Focus Group Interview Questions:

(1) Tell me about the mathematics involved in your majors and encore classes.

(2) How do these activities relate to what you have learned in your math class?

(3) Tell me about your attitude about learning math and what motivates you to learn math.

(4) How is your mathematics classroom a community?

(5) What have each of you learned about yourself by participating in your mathematics classroom community this year?

APPENDIX F

JOURNAL LOG ENTRY PROTOCOL

**Weekly Journal Entry Protocol**

**Participants will be given bound journals and will respond to the following prompts on a weekly basis.**

Journal Prompts:

What did you learn in your math class this week?

What did you like about your math class this week?

What did you dislike about your math class this week?

# APPENDIX G

## MATHEMATICS SCENARIOS

(Created by participants)

Once upon a time in the land of Math-All-Mighty, there was a cool group known as the Keck research gang. Now all the people in the gang could sing even Santana who only sang 1/5 of the time. Then, ole Xavier, he loved to sing to the Latina girls. He would even dance and serenade them at the same time. One day, he took one of the girls to buy a giant diamond for $50,000...but it was on sale for 25% off. No matter how much Xavier saved, the girl was still so happy. When Chad's girl saw the diamond, she wanted one, too. But, Chad quickly told her that she was so fine that he would buy her a brand new Jaguar instead. So off they went to the car lot and guess what? The Jags were on sale for 40% off. Now the salesman told Chad that the regular price was $75,000. But, Chad wanted to know the sale price because even though he loved his girl dearly, you know Chad will always go for a good deal. What ever happened to Nicee and Nicole. Last time, we talked to them, they were at the mall buying new cell phones and trying to determine whether to get Plan A (500 minutes for $59.99 per month plus 25 cents for each additional minute) or Plan B (Unlimited calls for $129.99 per month). They said after they finished with their cell phone business, they were going out to Golden Corral...trying to buy two meals for ½ the price. Jayceona got lucky and won the lottery for $500,000. Then, she not only took her girl, Christian, out to dinner but also took her to invest some of her money. Jayceona ended up investing $60,000 at 12% for 5 years. Of course, Carlos wanted a cut of Jayceona's big cash, but Jayceona was quick to set up a get rich quick scheme. So, she told Carlos that he would lend him $10,000 for 2 years if he paid it back at a rate of 20%. Even though Carlos knew Jayceona was getting over on him, he took the loan and paid back all the interest. When Ashley found out how all this money was getting moved around, she stopped and asked a few questions. She wanted to know how she could make some money, too. Xavier told her to just get a job and take care of herself. So Ashley did just that. She landed a job as the CEO of a computer company making a gross income of $200,000 dollars a year. Ashley loved the job. But after having federal taxes of $40,000 and state taxes of $20,000 taken out of her yearly salary, she was furious. It seems like Ashley had a lot of money but the government did not give her any breaks. So, Santana suggested that she invest some money so she could get more money back at tax time. So, Ashley invested $30,000 at 5% for 10 years. Santana was so proud of Ashley for listening to him that he invested also. But, he only invested $15,000 at 7% for 4 years. Finally, Nicee, Nicole and Christian decided that they wanted to become famous so they tried out for American Idol. You should have heard them rock the house. You won't believe they won and got an $800,000 contract each. But, they had to pay ¾ of the money in fees. So, using math outside of school did pay off. Even when Chad shoots three pointers on the court, he remembers the angle at which the ball goes in the hoop and sings a song in excitement. The crowds of 3,000 fans yell out in laughter at Chad. But only 45% of them know the song he's singing. Santana and Carlos don't want Chad embarrassed so they teach the song to the excited crowd and they begin throwing money out to them. They each collect $1,000 in all but have to give 7.5% of it back.

Initially, Santana and Carlos are upset about having to give some of the money back. But, Jayceona reassures them that if they need more money just to holla. Ashley reminds the gang of the moral of the story: “Whatever you do in life, you must always remember your math!”

APPENDIX H

MEMBER CHECK DOCUMENTATION FORM

**THE IMPACT OF HUMAN RESOURCE CAPITAL ON ETHNIC MINORITY MIDDLE SCHOOL STUDENTS' ENGAGEMENT IN A MATHEMATICS COMMUNITY OF PRACTICE AND THEIR MATHEMATICS IDENTITIES**

**Member Check Documentation**

Interviewer: Tracey Keck, M.Ed, UNCG

Name of Participant: ___________________ Pseudo Name: _________________

I have read the interview transcripts of my comments from the individual and focus group interviews. The interviewer has correctly and accurately presented my comments as stated by me in the interviews.

Participant's Signature ___________________________________

APPENDIX I

EXAMPLE OF HOW ONE THEME EMERGED FROM DATA

| **THEME** | **CATEGORIES** | **INDICATORS** | **DATA POINTS (no. of participant responses)** |
|---|---|---|---|
| Sociocultural Capital | Mathematics Community of Learners | Collaboration | Group work (14) |
| | | | Helping each other to succeed(6) |
| | | Communication | Communicating ideas about mathematics (10) |
| | | | Talking about mathematics lessons (7) |
| | | | Talking about doing mathematics (7) |
| | | Community | Team player (14) |
| | | | Common goals (9) |
| | | | All striving to do well (9) |
| | Connections to Mathematics | Social Networks | Participation in mathematics-related activities with family members (17) |
| | | | Participation in mathematics-related activities with friends (9) |
| | | Relevance | Participation in athletic activities related to mathematics (10) |
| | | | Participation in activities in elective/major classes related to mathematics (8) |
| | | | Knowledge of career requirements for mathematics-related careers (13) |